THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XI. No. 260—14th YEAR.] LONDON, OCTOBER 7, 1862. [Subscription per Ann. { 15s. in Advance / 18s Credit.] DOUBLE No. Price 1s.

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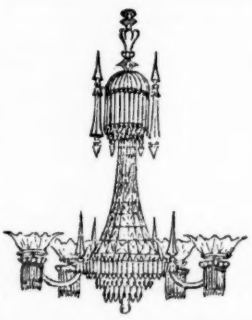

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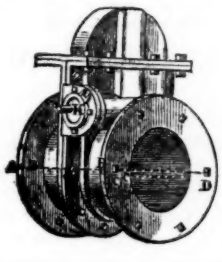

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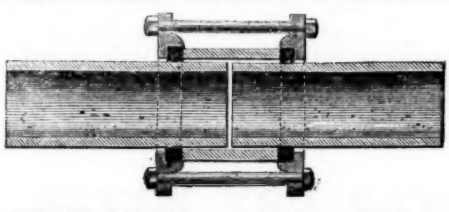

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ANOTHER

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1862,

To THOMAS GLOVER,

SUFFOLK STREET, CLERKENWELL GREEN, LONDON.

THOMAS GLOVER has great pleasure in informing Gas Companies and his other Patrons, that the *Jury of Class XXXI. of the International Exhibition of* 1862 have awarded, for his Patent Dry Gas-Meter, *a Prize Medal.* The reason given for this Award, in the Juries Official Report, is, "*For excellence of manufacture, as regards Dry Meters.*" See Official Report, p. 346.

It is worthy of remark, that the only two other Firms who receive Awards *both manufacture imitations of Thomas Glover's* Patent Dry Gas-Meter, and the reason given for these Awards is "*construction* and sound workmanship." Thomas Glover, therefore, claims that the *construction* of his Meter has obtained *three Awards from the Jury of the International Exhibition of* 1862; at the same time, *contrasting* the Award granted for his Meter by the words, "*For excellence of manufacture, as regards Dry-Meters.*"

The Prize Meter will be found in Class XXXI., No. 6301, connected with a 1-foot holder, to demonstrate that a 50-light Meter *measures and indicates accurately the small quantity of One Foot.*

WILLIAM PARKINSON AND CO.

(SUCCESSORS TO SAMUEL CROSLEY),

PATENT WET AND DRY GAS-METER MANUFACTURERS, &c.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

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W. P. and Co. invite especial attention to this Meter, which entirely overcomes the difficulty to which ordinary Wet Meters are subjected, owing to the short range of the Float, which is necessary, in order to meet the requirements of the Sale of Gas Act.

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STATION-METERS AND GOVERNORS,

Which can be seen at all the London Gas-Works. Also Liverpool, Manchester, Sheffield, Nottingham, Belfast, Glasgow, Birmingham, Dublin, Bristol, Leeds, Leicester, Brighton, Southampton, Sunderland, Wolverhampton, Bradford, Norwich, &c., &c.

TEST GASHOLDERS, EXPERIMENTAL METERS, EXHAUSTER REGULATORS,

MINUTE CLOCKS, PRESSURE GAUGES, PHOTOMETERS, PRESSURE REGISTERS, &c.

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TO CORRESPONDENTS.

Munster.—*The* Limerick Chronicle *has been imposed upon. We have neither directly nor indirectly sent any article or communication to that or any other Limerick paper.*

NOTICES.

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 7, 1862.

Notes upon Passing Events.

THE Blue-Book, containing the results of the Select Committee, appointed last session "to consider the practicability of adopting a uniform system of weights and measures," dry as it looks at first sight, has buried in its 270 pages, amidst the inevitable mass of verbiage, much that is really amusing, and something useful. The school of financial reformers, who have, for the present, failed in decimalizing British money, have now undertaken the infinitely more pressing and necessary task of decimalizing our weights and measures. There is this great difference between the two questions. Although our money system may be complicated to those who have to learn it—although it may add to the difficulties of account keeping—the mass of the people understand it. Labourers, and maids of all work can generally calculate their wages to a week, or an hour, and down to a farthing. Foreigners, except when visiting this country, are not so deeply interested in our money system, as in our weights and measures, for we sell to all the world. But there is not one educated person in a hundred, who has mastered, or is able to master the innumerable variations in British weights and measures; while those most widely accepted, require in business complicated calculations of a character exceedingly difficult for a foreigner to master—as for instance a ton, with its quarter, hundred-weight, and pounds. But it is much more easy to show the absurdity of our existing system, if system it can be called, than to point out how it can be changed. Even when the character of the change has been decided on by a sufficient majority of the commercial public, and embodied in an Act of Parliament, the difficulty of enforcing the Act remains—not insuperable, but most serious. The people of the Continent of Europe are accustomed to be regulated. Foreign Governments have a host of officials ready and accustomed to enforce their decrees; but, here we are in the habit of relying, to a great degree, on the people themselves to execute the laws. It would be very difficult to get farmers and corn-dealers of Norfolk or Suffolk to unite, to dispossess the provincial coomb of wheat in favour of the legal and imperial quarter. No one, unless he has paid special attention to the subject, can have any idea of the enormous variety of weights and measures that prevail in the three kingdoms. Thus, there are eighteen different lineal measures of land in use in ten districts, including Cornwall, Devonshire, Downpatrick in Ireland, Hertfordshire, Sussex, Flintshire, Yorkshire, Lancashire, and Somersetshire. Lancashire alone has four different measures, and these vary between 16 feet and 66 feet, each with the same name. There are twenty-five different superficial measures in use in about twenty districts. At Falmouth, the acre is 4840 square yards; at Preston, it is 4840, or 7840, or 9000, or 10,240, the last being also the Cheshire acre. A Scotch acre is 6084 square yards; an Irish acre 7840. In like manner, a rood is 63 square *feet* at Barnsley, and 64 square *yards* at Stoke-upon-Trent; at Patricroft, it is 49 square yards, and at Falmouth 1210 square yards. Wheat is sold by sixty totally different weights and measures: by bushels, which are expected at Wakefield, Doncaster, and Manchester to weigh 60 lbs.; but at the last place, if American wheat, 70 lbs.; at Darlington, 73½ lbs.; at Monmouth, 80 lbs.; and at Bridgend in South Wales, 168 lbs. In all, eighteen different weights of bushels of wheat are quoted. But wheat is also sold by gallons, by stones, and by loads, which last consist of 3 bushels at Pontefract, of 5 at Hitchin and Bedford, and of 40 at Bishop's Stortford. At Ulverstone, they sell by the load of 144 quarts; at Royston, of 488 quarts; at Bridgenorth, Much Wenlock, Ludlow, Leominster, Saltash, wheat is sold by the bag; but the bag is at one place 11 scores; at another 12; at another 11 scores 4 lbs.; at another 11 scores 10 lbs.; at another it is two bushels; at another it means a weight of 14 stones. At Nottingham, the bag is 36 stones; at Grantham, 40 stones. At Barnard Castle, Darlington, and Glasgow, they sell by the boll of 2 bushels in the English towns, and of 240 lbs. in the Scotch city. In North Wales, they sell by hobbets, but each market town has its own weight of hobbet. Belfast sells by the cwt. of 112 lbs., Dublin by the barrel of 282 lbs., Limerick by the stone of 14 lbs., Cork and Sligo by the barrel of 20 stones. Oats and barley are sold by different measures from wheat. Butter is offered in rolls, and in dishes of 20 ozs., 22 ozs., and 24 ozs.; in lbs., which are of 16, or 18, or 24 ozs. Sacks of potatoes are of 10 pecks, of 3 bushels, and of 140 lbs. At Preston, they are sold by the load of 240 lbs. Coals afford a series of weights and measures; so do wool and flax. There are no less than fourteen different weights indicated by the word "stone," which may be 5 lbs., or 8, or 10, or 14, or 15, or 16, or 16¾, or 18, or 24, or 32 lbs. A firkin of butter means 56 lbs.; of soap, 64 lbs. There are four different miles in recognized use in the United Kingdom. The English mile, 1760 yards; the Scotch mile, 1977 yards; the Irish, 2240 yards; and the geographical mile, which is one-seventh more than the English mile. There are three different tons; four different pounds. The fact is, that in spite of attempts to introduce uniformity, we have adhered to all our provincial and trade-weights and measures. The grocer has one pound, the apothecary another, and the goldsmith a third. With these facts before them, the committee reported very decidedly in favour of a uniform decimal system of weights and mea-

sures. It must be added that the facts collected are of more value than the opinions of the committee; for it was evidently formed with a foregone conclusion. Some of its pet witnesses made terribly long addresses. Professor Leoni Levi is a very clever man; but still he ought not to fill a Blue-Book with verbose preambles and compliments, more fit for the atmosphere of a literary institution in the country than the House of Commons. The report observes that "a standard of uniformity existed before the Conquest. It was enacted, in the time of Richard I., and declared by Magna Charta, that there should be one weight and one measure throughout the realm." Within a recent period of history, committees and commissions have considered the practicability of introducing a more simple and uniform system of weights and measures; and, as before observed, one decided attempt has been made to introduce a system of decimal coinage. The last Act for enforcing uniformity is the 5th and 6th William IV., c. 63. "The silent influence of usage has baffled the decrees of legislation. . . . We have no less than ten different systems of weights and measures, most of them established by law." The French have only one, founded on the "*mètre;*" and the French system has gradually made its way over the Continent, until it has become established in Holland, Belgium, Sardinia, and Tuscany, and is about to be extended to the whole kingdom of Italy, as well as Spain, Portugal, Switzerland and Greece. The Zolverein is accepting the mètre instead of the foot and the half kilogramme, as the basis of weight. A number of mechanical engineers have adopted the metric system. The late Mr. Locke made acquaintance with the decimal system while constructing his first French railway, and ever after adhered to it. Mr. Fairbairn gave evidence in favour of the metric system; so did Mr. Anderson, the manager of the Armstrong gun-factory at Woolwich. Mr. Bass, of bitter ale reputation, is on the same side; he thirsts for a uniform barrel. Sir Rowland Hill tells us that we lose 6 per cent. by the difference between our weights and those of France, and 17 per cent. on our German postal business. Schoolmasters believe that boys would learn as much in ten months as they now learn in two years, if decimal computation superseded our heptarchy of arithmetic. The grand objection is the difficulty of making the change. The committee propose to take the French system and the names with it. We do not believe that less than half a century would turn yards into "mètres" and pounds into "kilos." The committee ask for a central board of inspection, with a chief—a sort of Prefect of Police—for regulating weights and measures. This is a stumbling-block to begin with. England is rather sick of central commissions. The committee conclude by the following recommendations:—

1. That the use of the metric system be rendered legal. No compulsory measures should be resorted to until they are sanctioned by the general conviction of the public.
2. That a department of weights and measures be established, in connexion with the Board of Trade. It would thus become subordinate to the Government, and responsible to Parliament. To it should be intrusted the conservation and verification of the standards, the superintendence of inspectors, and the general duties incident to such a department. It should also take such measures as may from time to time promote the use, and extend the knowledge of the metric system in the departments of Government and among the people.
3. The Government should sanction the use of the metric system (together with our present one) in the levying of the Customs duties, thus familiarizing it among our merchants and our manufacturers, and giving facilities to foreign traders in their dealings with this country. Its use, combined with that of our own system, in Government contracts, has also been suggested.
4. The metric system should form one of the subjects of examination in the competitive examinations of the civil service.
5. The *gramme* should be used as a weight for foreign letters and books at the Post-Office.
6. The Committee of Council on Education should require the metric system to be taught (as might easily be done by means of tables and diagrams) in all schools receiving grants of public money.
7. In the public statistics of the country, quantities should be expressed in terms of the metric system, in juxtaposition with those of our own, as suggested by the International Statistical Congress.
8. In private Bills before Parliament, the use of the metric system should be allowed.
9. The only weights and measures in use should be the metric and Imperial, until the metric has been generally adopted.
10. The proviso (already noticed) in the 5 & 6 Wm. IV. cap. 63, clause 6, should be repealed.
11. The department which it is proposed to appoint should make an annual report to Parliament.

A letter, in the appendix to the report, addressed, in February, 1859, by the Astronomer-Royal to the Comptroller-General of the Exchequer, sets out very clearly the inconsistency of the present condition of our legislation, as respects weights and measures. It seems that, since 1824, the number of standards of length, weight, and capacity, amount to 26,699; and the number of reverifications since that date—that is of comparisons to secure accuracy, has been only 9969. As it is in London that the standards are most carefully corrected, it may safely be assumed that more than two-thirds of the provincial and inspectors standards have been used for more than twenty years without reverification. "There is no such thing in Britain as a public exhibition of a measure (length or capacity), or of a weight." At the date of the letter mural standards of length, 3 feet, 2 feet, 1 foot, 6 inches, and 3 inches, had been fixed two days on the external wall of the Observatory. "The Government takes no part in furnishing standards, or in compelling the local bodies to furnish themselves, or in enforcing the continued maintenance of the accuracy of the standards." Local bodies have not only to pay the price of standards, but also fees, and a stamp duty of £3. 10s.; so that it would seem to be the policy of Government to discourage the use of correct weights and measures by direct taxation. "The Government takes the most praiseworthy care for the exactness of the measure of gold coin. It issues coin without charge to individuals. It takes every opportunity, spontaneously, of removing those pieces of the coinage which have become incorrect; it permits no Mint to be worked, except under its own authority, and under the immediate supervision of its own salaried officers." That is to say, the man who receives British money may be sure that he has good coin; but, the man who receives goods, can be sure neither of weight nor measure, nor dimensions. In support of this opinion, another witness mentioned that whilst he was comparing a standard yard he had manufactured with that in the wall of the Observatory, two carpenters, passing, tried their two-foot rules, and found that they did not agree by the eighth of an inch with the two-feet standard measure. But although Mr. Airy's explanation of one undoubted evil is very clear, he does not come out creditably as a witness. There is a want of straightforwardness, and evident "fencing," in his answers, unworthy of the scientific position he holds. Indeed, the astronomer has so repeatedly failed, whenever he has grappled a practical question, whether it was railway construction or gas measurement, that there is no impertinence in wishing that for the future he may be allowed to stick to his proper profession—astronomy. Mr. Airy does not like the idea of decimalizing our weights and measures; that is quite legitimate. But surely the following are not candid answers to fair questions. The chairman says, "In France, the unit of weight is a gramme; that which corresponds with our ton is 1000 kilogrammes. Would not a clerk make out a calculation of the cost of the carriage of goods in kilogrammes more easily than in tons, quarters, hundredweights, and pounds? In one case, you would have to follow the decimal calculation; in the other, you would have to go from the ton to the hundredweight, which is 112 lbs.; then to the quarter, which is 28 lbs., and then to the pounds." To which Mr. Airy fencingly answers—"If he had a weight consisting of tons, he would never have to deal with pounds." A little further on he says, "You would never have to deal with pounds; you would stop at quarters." But then he is asked about sugar. He thinks a wholesale grocer would take no account of any pounds beyond a quarter of 28 lbs.—that he would give away 20 lbs., for instance. And he says, "When you measure a mile, you are not careful of a tenth of an inch." "I am not speaking of miles," says Mr. Ewart, "but of a quantity of sugar below 28 lbs." To which the Astronomer-Royal replies, "I have seen bills of ironfounders, in which the small quantities were not given!" A little further on Mr. Airy asserts, again and again, that "he would make a calculation in as quick time by the system of tons, hundredweights, quarters and pounds, or even omitting the pounds," as another would by the kilogramme; "and he could calculate the one as easily as the other." Mr. J. B. Smith asks—"Are you aware that a hogshead of sugar may be 3 tons 2 cwts. 14 lbs?" Mr. Airy answers—"Suppose it is?" and solves the difficulty by saying that it can be calculated by division! Mr. Smith then falls back upon cotton. Every bag of cotton has a different weight: it is sold by the pound, and weighed out at so many hundredweights, quarters, and pounds. In this case, the Astronomer-Royal admits that the French system would be the easiest. But then, he says that he could calculate the price at $6\frac{5}{8}$ per lb. as easily by our system as by the French decimal. If that be so, it proves the arithmetical powers of the Astronomer-Royal. Finally, he asks why the Liverpool merchants have adopted one-eighth of a penny, instead of a decimal division of a shilling? The answer is so ob-

vious that it must have been familiar to Mr. Airy: "Because one-eighth is the half of an existing coin—a farthing, and, therefore, most easily, under our system, brought back to pence, shillings, and pounds. Mr. Airy's prejudices are as remarkable as his disingenuosness, because in chemical, and almost all philosophical calculations, the decimal system has been adopted by men of all countries. When further pressed, Mr. Airy admits that "it is very wrong for the Custom-House authorities to resort to pounds." When closely pressed, he comes to the conclusion that the change would be of little benefit, because it would not much affect working people, who deal chiefly in ounces; or, men of science, who are independent of tons, and miles, and roods. In answer to the last question put to him, Mr. Airy admitted that "the decimal system is invariably used in astronomical calculations." We cannot even guess the meaning of evidence so contradictory.

The commission on embanking the Surrey side of the Thames had some wonderful plans and wonderful witnesses before them. Every noodle thinks himself equal to planning a railway, a dock, a viaduct, or an embankment. Mr. Thomas Henry Hadley is a marble merchant: he proposes to cut off a canal from the Thames by an intermediate embankment on the Surrey side, provided with locks, extending from London Bridge to Battersea. Handsome architectural-fronted warehouses, *boulevards*, a spacious carriage-road, and four lines of tramway, are included in his plan, with a weir across the river. He had made no precise estimate of the cost, but proposed to save two millions and a half, by executing the work in ten years, by five thousand sappers and miners. Mr. Hartley forgets that sappers and miners wear clothes, receive wages, and do work in proportion to their wages. Mr. Thomas Morris is an architect, and—leaving out of the question the main grievance, the flooding of Lambeth—he proposes to build a sort of bridge along the shore, on piers of brick 100 feet apart, *under* which the barge trade is to be carried on. Mr. Hartley's scheme is ridiculous; Mr. Morris's, useless. Mr. John Lightfoot is an architect and surveyor: he proposes a roadway on columns, and on embankments from the Tower to Westminster. Buildings of a magnificent description line his embankment, quite regardless of expense. The following passage is a beautiful sample of the poetry of an architect without practice:—"Immediately opposite the Temple, I propose to erect a building, to serve the purposes of a hall and club, to be presented to the benchers and members of the Inns of Court, as a compensation for the injury they may suffer from the embankment. The building in the centre, surmounted by sculpture, would present an agreeable appearance. In the centre, I propose an arch dedicated to Justice, flanked by a clock-tower and a police observatory." There is something truly delightful in the idea of the arch of justice, flanked by the police observatory! A little further on, Mr. Lightfoot provides libraries, baths and washhouses, and places for public worship. From architecture, sculpture, and philanthropy, he turns to sewage, which he proposes to collect, and, after draining away the liquid, transfer to vessels fitted with pumps and steam-power, to be carried away: while foul smells are to be burned in a large shaft. It is quite evident that Mr. Lightfoot has not read Mr. Haywood's report on the ventilation of sewers. To pay for all these fine things, he relies greatly on the semi-solid sewage, which is to bring in £351,200 a year. Of course, he quotes Liebig and Edwin Chadwick. Mr. Fairfax is a young man of 19 years old, engaged as a mechanic or mechanical engineer with Mr. Simpson. As usual, money is no object; and he proposes a solid embankment from Bankside to Westminster. The compensation at a million would be moderate. Really, the commissioners were long-suffering, enduring men—almost too patient. Mr. Sich, the next witness, had no description of his plan, the principal feature of which was a viaduct, on the suspension principle, from Bishop's Walk to Blackfriars Bridge—in order to take people a roundabout way from Lambeth—and a paved barge-bed. Mr. Pain is an architect: he proposes a long canal between Hungerford and Southwark, with docks and a towing-path. However, perhaps, amongst the string of schemers, there was none more a bore than Mr. Bird, whose introductory speech fills five folio columns. Mr. Bird evidently does not consider brevity the soul of wit. Really, these Thames Embankment Commissioners earned their honours, if any, very hard.

Circular to Gas Companies.

Our old friend, Dr. Abraham, has been again endeavouring to enlighten his fellow Commissioners of Sewers of the City of London on the subject of gas supply, more especially as regards uniformity of pressure. In the opinion of the learned doctor, the gas companies manage very badly, and, at the same time, cheat the public, by having a greater pressure in the mains in the evening than they have at midnight, and he adduces the authority of Mr. Hughes to support his views. He cannot understand why the pressure should not be the same when the street-lamps only remain burning as it is when all the shops are lighted. According to his notions, there should be an invariable standard of pressure in the mains, which no variable circumstances of supply should ever disturb. He seems to think that if any given degree of pressure be applied at the works, the same amount of pressure must be maintained in the mains at any distance, and that it will so remain, whether there be a full supply going or whether there be no gas burning. It is wearisome to have continually to expose the fallacy of such notions respecting the uniformity of pressure; and, we fear, it is a vain endeavour to try to persuade Dr. Abraham that he is mistaken. He will not be "bamboozled" by such reasons as convince ordinary men. We do not know whether his scientific mind has been brought to bear on the supply of water as well as of gas; but, if so, his daily experience should teach him that the water supplied to the upper cisterns of his house does not enter with nearly so much force—if at all—whilst those on a lower level are being filled; and he might as well complain of the water companies for this irregularity of pressure as charge the gas companies with mismanagement because they do not maintain the same pressure in their mains at all times of the day and night. Under any circumstances, the pressure of gas in the mains at a distance from the source of supply, must be less than it is at nearer points, but the quantity supplied to all the public lamps may, nevertheless, be rendered more uniform by the use of regulators, which are now extensively applied to each lamp. The report which Mr. Haywood, the City engineer, has promised shortly to make to the Commissioners, of the results of the experiment, undertaken at their request, of applying meters to several of the public lamps, will most probably show how groundless have been the complaints respecting the deficiency of the supply. Thirty-six meters have been applied to lamps in different parts of the City, which Mr. Haywood stated are watched by day and by night, and his report will prove, not only whether the gas burned in those lamps is greater or less than the stipulated quantity, but it will determine, to a great extent, the merit of the carburetting process, by ascertaining, in cases of defective lighting, whether the fault is due to the carburator or to a deficiency in the supply of gas. At the same meeting of the Commissioners of Sewers, the danger of having private gas-works in the City was again brought under consideration, two fires having been caused within a month by the manufacture of gas on private premises.

The report, in another part of our Journal, of the proceedings at the last meeting of the Metropolitan Board of Works, which was chiefly occupied with the consideration of the applications for licences to store petroleum, shows that the Petroleum Act of last session, though limited to rock-oils, is producing much inconvenience to traders in that American product; and some estimate may be formed of what its operation would have been on gas companies had Lord Kingsdown's amendment been retained, by which gas-tar would have been brought within the provisions of the Act. The proceedings show, at the same time, the reckless manner in which some of the importers of rock-oils were carrying on their business, and the necessity of some such restrictions as those imposed by the Act on the storeage of petroleum for the protection of the public. The first thing done by the Board was to confirm the recommendation of the Streets Committee, to whom the matter had been referred, to the effect that the parties making applications for licences should be required to send full particulars, with a plan of the premises proposed to be used for storing petroleum, with a view to the examination of each place by the proper officer of the Board. They then proceeded to consider the application from Messrs. Timothy and Co., of Millwall, whose premises had been examined by Mr. Vulliamy, the superintending architect of the Board, and the result of his examination and his recommendations were submitted to the

meeting. It appears from his report, that between 2000 and 3000 barrels of petroleum, each containing upwards of 22 gallons, are now stored on the premises, and that preparations are making there for storing nearly four times that quantity. The fire offices took alarm, some time since, at the large accumulation of the highly inflammable fluid on those premises; and, on their representation, an inspection was made, in April last, by a Government surveyor, who suggested various alterations for the prevention of the spread of fire, which have since been attended to. Notwithstanding these precautionary measures, the neighbours of Messrs. Timothy and Co. continue to be alarmed, and the fire office in which one of them was insured has declined to continue his policies; he, therefore, strongly urged the Board not to license the premises. In the present method of storing the casks containing petroleum, they are piled one upon another, three deep; and, as the principal danger in case of fire arises from the petroleum getting loose, by the bursting of the casks, and flowing about in a blazing state, Mr. Vulliamy proposes that the casks should be all stored in tanks sufficiently large to hold their entire contents; so that, in case they should take fire and burst, the flames might be confined within that space. He also recommended a limitation to the quantity stored on the same premises, and that licences should be granted for a certain time only. Such a provision as that proposed by the superintending architect of the Board of Works seems well adapted to prevent the extension of fire beyond the premises in which petroleum is stored; and, though it would occasion great expense in the first instance, it is one of those necessities to which the traders in dangerously-inflammable articles must submit, if they carry on their business in populous neighbourhoods. The plan recommended was well received by the Board, and the report was ordered to be printed for further consideration. An application was next made for a licence to store petroleum in a large vault under a stable, the only access to the vault being by cellar-flaps, which afforded the only means of ventilation. The licence in this case was very properly refused. There were several other applications for licences, the consideration of which was deferred; as it will be necessary, in accordance with the recommendation of Mr. Vulliamy, to survey the premises in each case, to ascertain whether they are fitted for the purpose. During the discussion, a remarkable instance of the little dependence that is to be placed on opinions of the non-inflammability of petroleum was mentioned by Alderman Lawrence. He stated that some experiments were very recently made by "an eminent chemist" before some members of the Court of Aldermen, for the purpose of showing that a specimen of petroleum which he brought with him would not inflame on the application of a lighted match; but, to his great surprise and vexation, when the light was brought near the petroleum, it blazed up furiously.

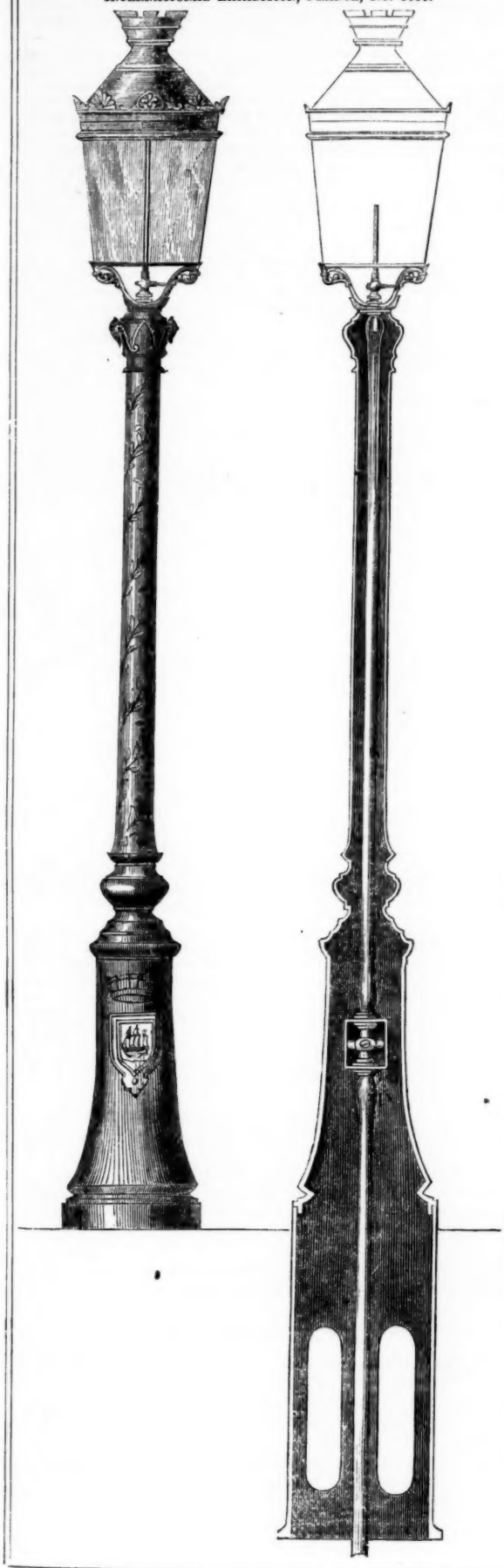
The cheap gas movement at Cardiff, after having been for some time in abeyance, is again making active demonstrations. The prospectus of a consumers company has been issued, with a proposed capital of £30,000 in £1 shares, with a sixpenny deposit, which professes to supply gas of excellent quality, at 2s. 6d. per 1000 feet, with a further reduction in price when the profits exceed 10 per cent. For the purpose of giving a stimulus to the gas consumers to support the company, a meeting was held on Wednesday last, at which Mr. Flintoff discoursed as usual, and in his customary strain. The harmony of the meeting was, however, disturbed by the appearance on the platform of the former secretary of the company, to bring charges against its principal promoter. The details of those charges he was not allowed fully to disclose, as they were considered to be personalities not relevant to the object of the meeting; but it appeared, from what he was permitted to divulge, that, when in alliance with Mr. Flintoff, he wrote letters to the local papers in an assumed name for the purpose of forwarding his plans, and of bringing him into notice. Mr. Flintoff, though very liberal of abuse to others, is extremely irritable at the same caustic application to himself, and he was much annoyed by such remarks of his former colleague as that person could utter; for we are informed by the Cardiff paper that he threatened the proprietor with legal proceedings if those remarks were published in the report of the meeting. He wishes to monopolize the privilege of abuse, and the sensitiveness he exhibits, when any one attempts to infringe his assumed prerogative, indicates a strong dislike to disclosures respecting himself and his antecedents.

Our contemporary, who claims to be the "official gazette" of gas lighting in America, joins in chorus with the other New York papers in deprecating the addition to the price of gas of the excise duty recently imposed by Congress. The article on this subject, which we reprint in another column, is a specimen of American journalism of the lowest kind, and may take rank with the choicest productions of the Flintoffs and Hugheses of the mother country. The officers of the New York gas companies are accused of having bribed and treated members of Congress to introduce the clause in the excise Act which empowers the companies to charge their customers with the duty. The shareholders are said to be men "wallowing in wealth," who "conspire to punish the people;" they are represented to be "making over 100 per cent. per annum profit;" and to be committing "a mighty wrong upon Congress, and an untold wrong on their fellow-citizens;" and this professing organ of the gaslight interest urges the Common Council of New York "to try the right of the city to assume the charters of these companies." The folly, impudence, and recklessness of these assertions even surpass any that we are accustomed to on this side of the Atlantic from the declared enemies of gas companies. The alleged bribery of members of Congress would have been far more profitably directed in exempting gas from taxation than in regulating its payment, for the consequent rise in price must necessarily reduce the profits of the companies by diminishing consumption; and the amount of the tax charged to consumers bears no proportion to the extra cost of production arising from the depreciation of the currency. It would be difficult for the assailants of the New York gas companies to assign a reason why the price of gas should not be raised, with that of every other manufactured article, according to the diminished value of the paper money received in payment; yet there has been no addition to the price beyond the special excise duty which the law enacts shall be charged to the consumers. We have had recent experience of the loss which the depreciation of the currency causes to those who desire to convert paper into gold. The coupons of some American bonds of which we are holders realized a year ago 4s. 1d. per dollar in London; but now, the best price offered is 3s. 1½d. Some estimate may be formed, from this reduction in the value of nominal currency, of the rise in prices in America of labour and of all articles, either of foreign or of native produce, which must be paid for in gold or in gold's worth. So far from deserving the opprobrious charge of neglecting their duties as citizens, the New York gas companies have taken an active part in carrying on this unhappy war, by raising a regiment, whose triumphant return from the battle-field, under the command of the president of the principal gas company, was chronicled by our contemporary in the number previous to the one in which the gas companies are accused of refusing to assume their fair proportion of the public burdens, and of "sneaking out" of their share of responsibility.

Few of the visitors to the International Exhibition who take interest in the distribution of gas, more particularly in its supply to street-lamps, will have failed to notice two elegant candelabra, placed at the entrance to the French department, underneath the west wing of the picture-gallery. They are specimens of the pillars, lamps, and fittings, adopted by the municipality of Paris; and they are exhibited by Messrs. Lacarrière and Co., of that city; the number in the catalogue being 3059, in Class XXXI. We give, on the opposite page, an engraving of the pillars, in the hope that they may tend to improve the taste of our manufacturers and municipal authorities, and be the means of expelling from the streets of London the constructions of conglomerated ugliness, in which the forms of cannon, of the leaves of plants, and of gibbets, are combined, to elevate the jets of gas, confined within rectangular glass cases. The pillars exhibited are electro-bronzed, which greatly improves their appearance, but, at the same time, it adds considerably to their expense; and, if the first cost of bronzing be objected to, paint might be substituted. The lantern is circular, divided into four segments; but it does not appear to advantage in the engraving. In Paris, a gauge-cock is introduced in the pillar, which is so adjusted, according to the average pressure, as to pass the required quantity of gas. The base will, however, admit of the introduction of a cylindrical dry gas-meter; and, when the local authorities adopt the method of supplying gas to public lamps through meters, such pillars as those exhibited by Messrs. Lacarrière and Co. would enable them to do so very conveniently, without having recourse to the unsightly contrivance recommended by Mr. Hughes.

PARIS LAMP-POSTS AND LANTERNS.

INTERNATIONAL EXHIBITION, FRANCE, No. 3059.



Register of New Patents.

3090.—HECTOR ALEXANDER, of Glasgow, in the county of Lanark, N.B., gas-burner manufacturer, for "*Improvements in turning-apparatus for making gas-burners.*" Patent dated Dec. 10, 1861.

In a modification of apparatus embodying the improvements, the rod to be shaped into burners by turning is held and rotated in a chuck upon the spindle of a head-stock, such as is commonly used. Three or more tools are brought to bear upon the rod, one shaping out the outside, a second finishing it, and a third boring out the interior. The holder of the first tool is made capable of a slight movement inward and outward, whereby the diameter of the burner is varied, and is mounted upon a slide, which moves on guides, parallel to the head-stock. As the burner is being gradually turned down into shape, this slide is made to move along, by means of a weight or weighted lever. At the back part of the tool-holder, there is a small anti-friction pulley, which bears against a pattern-guide; and it is the shape of this guide which determines that of the burner. This pattern-guide is centred on a pin, so that it can be moved out of the way whilst the tool is moved back; and it is put into acting position by a lever, being held and supported there by a second lever or stop, held up behind it by a spring. The finishing and boring tools are carried by an arm or bracket, jointed to the tool-holder slide in such a manner that they can be turned over out of the way.

3148.—WILLIAM HUSBAND, of Hayle, Cornwall, for "*An improved water-safety valve.*" Patent dated Dec. 14, 1861.

Engines for pumping or forcing water are frequently subjected to great danger, by reason of their load being suddenly withdrawn either on account of the bursting of pipes or other causes, the consequence of which is that the working parts of the engine and pump, being unexpectedly relieved from the opposing pressure of water on the plunger, acquire a velocity of motion sufficient to cause serious damage and destruction to the entire machinery. This invention has for its object a means whereby, in the event of the aforesaid accidental removal of the load from the engine, another load is substituted, which controls the speed of the engine, and prevents the results mentioned.

At a short distance from the engine, and to the pipe leading therefrom to the main, along which the water is to be forced, an elbow-joint is to be bolted, on the upper part of which, by means of suitable flanges and bolts, a bed-plate is fixed, on which four standards are secured, at equal distances apart, their upper extremities being firmly fixed in position by means of a cross-head, which is provided with a slot in the centre, in order to allow of the vertical movement of the guide-rod of a plunger, which passes down between the standards and through a stuffing-box on the bed-plate into the upper portion of the elbow-joint, around the interior of which, on a level with the upper portion of the pipe from the engine, the stationary parts of the valve are fixed, consisting of vertical arms or plates, on the top of which a circular ring or plate is secured, having its opening situated directly beneath the plunger or pole, which is made so that it may, when desired, fit thereon, and form a water-tight joint. Above this circular plate, or what may be termed the bed, on which the plunger or pole descends, and bolted, or otherwise secured to the sides of the plunger, are four or six arms of a curved form, which extend outwards and downwards beyond the plate, in order to be attached to the vertical slides of the valve, which are thus opened and closed simultaneously with the valve which the area of the lower surface of the pole forms with the circular plate, which latter is to be furnished with arms, brackets, or other supports, extending from its lower surface near the opening to the edge of the pipe, or to the lower portion of the fixed vertical slide-valves.

The operation of the apparatus is, that whenever the engine is to be started, or when the pressure of the water in the main is ascertained, the pole or plunger is to be weighted as follows:—it is provided, at a short distance above the stuffing-box, with a fixed circular table to sustain a series of weights in the form of discs, having a channel cut therein, which enables them to be placed around the pole one on the other. The table has four projections, furnished with slots, which enable it to slide vertically on the standards by the action of the pole, and it is controlled in its descent by means of a flange covered with india-rubber on each of the standards a short distance below the projections, whereby the jar caused by the sudden descent of the table and pole is modified, thereby relieving the valve from unnecessary shock. The table is to be weighted so as nearly to equal the pressure of the water upon the area of the pole or plunger; the consequence will be that the pole and system of valves will be raised by the pressure of the water, and a free opening will result for the passage thereof from the engine along the main-pipe; but, in the event of any accident occurring to the main-pipe, whereby the pressure of the water is suddenly taken away from the engine-pump, and which would in the ordinary course of operations entail such a rapid motion of parts as to cause destruction to the machinery, the pressure is also instantly removed from the area of the pole or plunger, which then descends and closes with it the system of valves, thereby throwing the whole load of the weighted plunger upon the engine and pump, and controlling them from the destructive speed they would otherwise acquire. The area of the plunger may be of any desired extent, and the table weighted accordingly.

The plunger or pole may be used in conjunction with the circular plate, and form a valve without the addition of the vertical slide-valves; in some instances, where there is not much pressure of water, or where the size of the pipe is small, the elbow-joint may be dispensed with in these instances.

The claim is for the general arrangement of parts and apparatus, constituting "an improved water safety balance valve," substantially in the manner hereinbefore specified.

3167.—SAMUEL SHEPPARD, of Birmingham, Warwick, manufacturer, for "*A new or improved tap or stop-cock.*" Patent dated Dec. 18, 1861.

The body or barrel of the tap is situated in a line with the inlet-pipe of the tap, and the outlet-pipe is at right angles thereto. The inlet-pipe opens into the barrel or body near the bottom thereof.

The valve employed is an ordinary loose or fixed valve, which works upon a valve-seat at the bottom of the body or barrel. The valve is pressed upon, and raised from its seat in the following manner:—In the barrel or body is a cylindrical plug made to fit the same, and at the lower end of the plug is a washer or collar of leather or cork, or other packing material, which effectually secures the tight fitting of the plug in the barrel. The inner end of the plug carries the loose or fixed valve, and the outer end of the plug is provided with a handle, by means of which a rotatory motion can be given to the plug. The rotatory motion is made to cause the plug to advance into, or retire from the barrel, and to press the valve upon its seat, or liberate it therefrom in the following manner:—Near the front end of the barrel is an inclined slot, passing about one-half round the barrel after the manner of a thread of a screw. A pin or projection engaging in the slot is fixed to the plug; and, on a rotatory motion being given to the plug, it is made also to move in the direction of its axis by the engaging of the pin in the slot. The inclined slot may be made in the plug, and the pin fixed in the barrel or body with the same effect. By turning the before-mentioned handles in one or other direction, the tap or stop-cock may be opened or closed. The positions of the inlet and outlet-pipes may be varied to suit taps or stop-cocks of various kinds.

3191.—Joseph Westwood, of the London Yard, Poplar, London, ship-builder, for "*An improvement in the construction of hydraulic presses.*" Patent dated Dec. 20, 1861.

This invention has for its object the construction of hydraulic presses in such a manner that the cylinder and ram are capable of being moved to one side or the other of the press, by means of traversing-gear fitted to such cylinder.

For this purpose, the cylinder containing the ram is fitted with a traversing motion, consisting of a wrought-iron ring, into which the bottom end of the cylinder is fitted. The ring has straight sides, which work in V-guides; and on the upper side of the ring are formed two bosses, one on each side of the cylinder, such bosses having internal screws, through which are passed two wrought-iron screws, mounted, in suitable bearings, on each side of the lower cross-head of the press. These screws have each a spur-wheel at one end, gearing into a pinion, mounted in the centre of the width of the lower cross-head, and worked by a winch-handle. By this means, the cylinder and ram are capable of being moved from one side of the press to the other on the lower cross-head, as may be required; but the traversing-gear above-described may be varied.

3208.—William Mattieu Williams, of Handsworth, in the county of Stafford, teacher, for "*An improvement or improvements in treating coal and other bituminous minerals and peat, in order to obtain solid and liquid hydrocarbons therefrom, and in apparatus to be used for that purpose.*" Patent dated Dec. 21, 1861.

The object of this invention is so to treat coal and other bituminous minerals and peat as to increase the solid and liquid, or more valuable products, in proportion to the gaseous or less valuable products. The gaseous products of the distillation are mainly or largely produced by the decomposition of the vapours of the solid and liquid products, occasioned by their coming in contact with portions of the retort, or by its contents being heated to a higher temperature than that at which the said vapours are liberated from the coal. By conducting the distillation in the manner, and by means of the apparatus hereinafter described, the over-heating of the condensible products first volatilized from the coal is prevented, and a larger yield or produce of such condensible products is secured.

The distillation is conducted in a furnace, through the bottom of which the lower part of the retort or distillatory vessel descends. On the furnace-bed is built a jacket or casing, open at top and bottom, within which casing the retort is situated. The body of the retort is of the same shape as, and a little less than the said casing, and its lower part is funnel-shaped, terminating in a pipe. The top of the retort is open, and is provided with a lid, which is luted tightly in its place during the distillation. The fire of the furnace plays upon the said lid, and around the jacket or casing, and the heat communicated to the sides of the retort by the said jacket is very steady, and uniformly diffused. The coal or other matter to be treated is placed in a cage or tray, the sides of which are perforated or made of bars, and the heat from the top of the retort radiates downwards upon the contents of the cage, and liberates volatile hydrocarbons therefrom, which pass out at the sides and bottom to the lower part of the distillatory vessel, from which they pass by the before-mentioned pipe into a receptacle, where the condensation of the condensible products may be completed. The distillation may either be conducted at atmospheric, or at a greater or less degree of pressure. In the first case, the terminal pipe of the retort is open, and the condensed products run therefrom; in the latter, the said pipe is closed by a weighted valve so as to give the required pressure, and it is connected with exhausting apparatus worked by steam or otherwise.

The claims are for—

1. Treating coal and other bituminous minerals to procure solid and liquid hydrocarbons therefrom, by subjecting these substances to a distillatory process, so conducted that the volatile products pass rapidly downwards from the heated part of the apparatus, so as not again to be exposed to a temperature equal to that at which they are produced.

2. Constructing and arranging the retorts or distillatory vessels, so that heat is applied to the top of the said vessels, and the volatile products, conducted by a descending motion from the heated parts of the said apparatus.

3243.—Thomas William Atlee, druggist's factor, of Birmingham, for "*Certain improvements in cocks or taps for drawing off fluids.*" Patent dated Dec. 27, 1861.

These improvements in taps consist in forming a spiral thread or groove, or threads and grooves around the shanks of taps, which, otherwise, may be of any ordinary construction.

3256.—George Henry Birkbeck, of the firm of Tongue and Birkbeck, of 34, Southampton Buildings, Chancery Lane, London, patent agents and engineers, for "*Improvements in apparatus for raising or forcing water, or other fluids.*" A communication from Mr. Edward Bruce Boughton Barker, H.B.M., Consul at Samsoun and Sinope, Black Sea. Patent dated Dec. 30, 1861.

This invention has for its object improvements in apparatus for raising or forcing water, or other fluids, by means of compressed air, and consists in improvements on a former patent granted to the present patentee, on the 22nd of September, 1860, No. 2318.

In the specification above alluded to, an arrangement is shown and described in which an air-pump is worked by a steam-engine or other motive-power, such air-pump being in communication with two chambers, into which the matter to be lifted or forced is alternately drawn and discharged by the reciprocating action of the air-pump. It will be found that, in this arrangement, a loss of power is incurred by compressing the air contained in the pipes between the air-pump and such water-chambers to a density or pressure equal to the weight of the water to be lifted or forced, and then relieving such pressure, in order that the water may flow into such chambers. Now, the object of the present improvements is to avoid such loss, which is accomplished in the following manner:—Above the water-chambers is placed a valve-box, having three branches, one to each of the water-chambers, and the other connected to the pipe leading to the air-pump or pumps. Within such valve-box is a valve, which it is preferred to call the reversing-valve, capable (by means of a system of levers and rods) of being actuated by the engines so as to open or close the communication between the air-pump or pumps, and one or the other of the water-chambers, the compressed air being directed on to the surface of the water in one of the chambers, so as to displace the water contained therein, and cause it to flow up the up-cast pipe to the height required. When the water has been nearly all discharged from the chamber which is, for the time being, in communication with the air-pump, the engine acts on the reverse valve, and causes the compressed air to act on the surface of the water contained in the other chamber, which has been filling with water during the time of the discharge of the contents of the first-mentioned chamber. By this arrangement, the air in the pipes between the air-pump and the chamber, when once compressed, is kept at the density or pressure equal to the weight of the column of water to be lifted. On the top of each chamber an air-escape valve is fixed to allow the air to escape, in order that such chamber may refill with water. These valves are connected to the reverse-valve by rods, or other suitable means. The air-pump is double-acting, having valves at top and bottom, opening inwards for the admission of the outer atmosphere, and valves at the top and bottom, opening outwards, connected by branches to the air-pipe, to prevent the return of the compressed air into the cylinder.

The arrangement of the several valves and chambers may be varied, without departing from the character of the invention, which consists in arranging apparatus so as to maintain the pressure to which the air is compressed at a density equal to that of the column of water, or other fluid, to be raised or lifted thereby.

3264.—Neill M'Haffie, of 16, Summer Street, Mile End, Glasgow, for "*Improvements in ventilators or valves for regulating the passage of air, or other fluids, whether of a gaseous or liquid form.* Patent dated Dec. 31, 1861.

This invention has for its object improvements in ventilators or valves for the admission of external air into buildings, and for regulating the passage of fluids. In the use of valves or ventilators for the admission of external air, considerable inconvenience is experienced from the irregularity of the quantity admitted, which is liable to change from a variety of constantly-recurring causes; amongst others, the alteration of the temperature of the external air, the raising or lowering of the temperature of the room or chamber in which such valves or ventilators are placed, sudden gusts of wind without, or opening of doors within, frequently causing draughts of a dangerous nature.

According to this intention, when applying a ventilator or valve for admission of external air, the current of air entering is caused to impinge on a surface so arranged, that when the current of air exceeds the velocity considered desirable, the surface may be able to yield to it, and, on yielding, may close, or partially close the valve; when the force of the current diminishes, the valve again opens, it being so weighted as always to tend to do so. For the passage of liquids, this last-mentioned surface should be mounted on a horizontal axis; but, instead of being at or near its lower, it should be at or near its upper extremity, on account of the greater density of the fluid, the passage of which is sought to be regulated.

3267.—William Spence, of 50, Chancery Lane, London, patent agent, for "*Improvements in deflectors for lamps.*" A communication from Lemuel Beers, of Newtown, Fairfield, in the county and State of Connecticut, United States of America. Patent dated Dec. 31, 1861.

This invention has for its object the prevention of the partial obscuration of light from the lamp, caused by surrounding the flame with a deflector composed of an opaque material; and consists in the substitution of a deflector composed of glass, or other transparent material, for that which is ordinarily composed of metal. The deflector is in form similar to those in ordinary use, as applied to lamps in which kerosene and other heavy oils are burned; such form being that of a hollow cone, with a hole at the top, of the form required to suit the form of the wick.

APPLICATIONS FOR LETTERS PATENT.

2571.—Johan Bernhard Giertz, of Great St. Helen's, London, E.C., for "*Improvements in gas-burners or jets.*" Sept. 19, 1862.

2597.—Richard Archibald Brooman, of 166, Fleet Street, London, E.C., for "*Improvements in lighting apparatus.*" A communication. Sept. 23, 1862.

2609.—William Upfill, of Birmingham, Warwickshire, iron-merchant and manufacturer, and William Ashbury, of the same place, engineer, for "*Improvements in the manufacture of metallic bedsteads, part of which improvements are also applicable for ornamenting tubes, and curtain, and cornice-poles.*" Sept. 24, 1862.

2613.—Thomas Kennedy, of Kilmarnock, Ayrshire, N.B., water-meter manufacturer, for "*Improvements in taps or valves.*" Sept. 25, 1862.

2615.—John Raywood, of Sheffield, Yorkshire, for "*Certain improvements in the construction of gas apparatus for the prevention of fraud, and for economizing the consumption of gas.*" Sept. 25, 1862.

2634.—Michael Henry, of 84, Fleet Street, London, E.C., patent agent, for "*Certain new and improved applications of petroleum and its products, certain agents produced by combining the same with other substances, and certain modes of treating caoutchouc, gutta-percha, and their compounds, and substances similar thereto.*" A communication. Sept. 27, 1862.

2656.—George Haseltine, of 100, Fleet Street, London, E.C., for "*Improvements in the means for, and mode of, warming and ventilating buildings.*" A communication. Oct. 1, 1862.

2664.—William Crane Wilkins, of Long Acre, London, W.C., light-house engineer, for "*Improvements in gas-burners.*" Oct. 2, 1862.

GRANTS OF PROVISIONAL PROTECTION.

1516.—Timothy Morris and Robert Weare, both of Birmingham, Warwickshire, and Henry Edward Cradock Monckton, of Fineshade, Northamptonshire, Esquire, for "*Improvements in obtaining and applying light and heat by electricity.*" May 19, 1862.

2412.—John Gay Newton Alleyne, of the Butterley Iron-Works, Alfreton, Derbyshire, and Julius Roberts, of 3, Essex Court, Temple, London, E.C., captain in the Royal Marine Artillery, for "*Improvements in the manufacture of flanged wrought iron or steel plates, and of wrought iron beams and frames of a trough-shaped section, and in the apparatus employed for that purpose.*" Sept. 1, 1862.

2555.—John Henry Johnson, of 47, Lincoln's Inn Fields, London, W.C., and of 166, Buchanan Street, Glasgow, N.B., for "*Improvements in gas-burners.*" A communication. Sept. 17, 1862.

2560.—William Herbert Browne, of Theobald's Road, and Henry Armstrong, of Manchester Street, London, gas engineers, for "*Improvements in dry and wet gas-meters.*" Sept. 18, 1862.

NOTICES TO PROCEED.

1496.—Christopher Binks, of Parliament Street, Westminster, London, S.W., for "*Improved methods of obtaining oxygen and chlorine gases.*" May 17, 1862.

1516.—Timothy Morris and Robert Weare, both of Birmingham, Warwickshire, electricians, and Edward Henry Cradock Monckton, of Fineshade, Northamptonshire, Esquire, for "*Improvements in obtaining and applying light and heat by electricity.*" May 19, 1862.

1533.—Macedo Alexandre Le Brun Virloy, of No. 9, Rue Pigalle, Paris, civil engineer, for "*Improvements in drying and carbonizing wood, peat, and other fuel.*" May 21, 1862.

1551.—William Roberts and Thomas Greenacre, of Millwall, London, E., for "*Improvements in cocks or valves for steam or other fluids.*" May 22, 1862.

1574.—Jean André Cécile Nestor Delpech, of Castres, France, manufacturer of engines and machinery, for "*Improvements in pumps.*" May 26, 1862.

1607.—John Henry Johnson, of 47, Lincoln's Inn Fields, London, W.C., and of 166, Buchanan Street, Glasgow, N.B., gentleman, for "*Improvements in the manufacture of tinned lead pipes, and in the apparatus employed therein.*" A communication. May 28, 1862.

1955.—Joshua Kidd, of Cannon Row, Westminster, London, S.W., engineer, for "*Improvements in gas-meters.*" July 7, 1862.

2380.—William Edward Newton, of 66, Chancery Lane, London, W.C., civil engineer, for "*An improved method of producing light for the various purposes of artificial illumination.*" A communication. Aug. 27, 1862.

2426.—William Hunt, of Tipton, Staffordshire, manufacturing chemist, for "*An improvement or improvements in the manufacture of muriate of ammonia.*" Sept. 2, 1862.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

2096.—Nathan Defries, "*Improvements in gas-meters.*" Sept. 14, 1859.

2121.—Samuel Newman Rodier, "*Improvements in the regulation of gas to burners, which he called 'Rodier's regulating gas-valve.'*" Sept. 17, 1859.

2136.—John Court, "*Improvements applicable to gas, and other lamps, and lights, and also gas-stoves, for effecting more complete combustion therein.*" Sept. 19, 1859.

2150.—George Dannett Robinson, "*Improvements in apparatus for regulating the pressure of gas and other fluids.*" Sept. 21, 1859.

2157.—John Dales, "*Improvements in purifying sewage and other impure waters, and in separating therefrom materials suitable for use as manure, and also the preparation of a substance to be employed for such purposes.*" Sept. 22, 1859.

2177.—David White, "*Increasing the illuminating and heating powers of gases, and regulating the flow of gases, and improvements in the material for gas-meters, and improvement in glass and cylinder-holders.*" Sept. 26, 1859.

2194.—Edmund Small Cathels and Samuel Splatt, "*Improvements in gas-meters.*" Sept. 28, 1859.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

2091.—John Gray, "*An improved water-closet arrangement.*" Sept. 17, 1855.

2163.—Richard Locke Johnson, "*Improvements in the manufacture of gas for illumination from peat or other substances, and in the apparatus employed in such manufacture.*" Sept. 28, 1855.

Miscellaneous News.

SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY.

The Half-Yearly Meeting of Proprietors was held at the London Tavern, on Thursday, the 2nd inst.—T. B. Simpson, Esq., in the chair.

The Secretary (Mr. Livesey) read the notice convening the present, and the minutes of the last meeting; also, the following report of the board of directors:—

The directors, in presenting their usual half-yearly report, have much pleasure in congratulating the proprietors on the continued prosperity of the company—the account for gas supplied for the six months ended at Midsummer last (the first half year at the present price) being nearly £2000 in excess of the corresponding period of 1861.

By the accounts to be submitted to the meeting, it will be seen that the rental for gas and the receipts for products, &c., amount to £39,009. 4s. 7d., and the expenditure for the same period to £29,727. 11s.—leaving a balance of £9281. 13s. 7d., which, with the unappropriated balance of £639. 4s. 2d. at December last, has to be disposed of at this meeting.

The reserve-fund of £20,000 is completed, and invested in Consols, and the interest thereon, in compliance with the company's Act of Incorporation, will for the future be placed to the credit of the revenue account.

The directors, at the last meeting, informed the proprietors that it would be necessary to make some extensive additions and alterations to the works and mains, and, in accordance with that intimation, a new retort-house has been erected, a second chimney-shaft has been built, and an additional coal-lift, with all the requisite apparatus, is nearly finished. The coal-stores have also been considerably enlarged, and it is expected the new gasholder will be ready for use in a few weeks. These extensions, together with the improvements recently made in the mains in several parts of the district, will enable the directors to meet any demand for gas which may arise during the approaching winter, and, in all probability, for some time to come.

The company's gas is periodically tested by the parochial officers of the district, and is invariably found above the parliamentary standard of illuminating power, and free from the ordinary impurities.

The several calls made by the directors towards completing the capital account have been regularly and satisfactorily met, and many of the proprietors have paid in advance the whole amount due on their shares.

The directors have further to report that, in order to have every facility in their power for extending the business of the company, they have purchased another piece of freehold ground, adjoining the premises in their occupation, which will enable them to make some important additions to the works when required.

The directors, in conclusion, beg to recommend that a dividend at the rate of 5 per cent. for the half year ended the 30th of June last, be now declared.

The Chairman: Gentlemen, in moving "That the report be received, and entered on the minutes," I have but very few remarks to make, for really I have little else to communicate beyond what is contained in the report. We have great pleasure in meeting you on these occasions—more particularly when we can assure you, without any doubt whatever, that your works are in a very excellent condition, and that, in fact, everything connected with the company is in a state of prosperity equal to that which every proprietor could possibly desire. You are aware that we have made calls for the remainder of the amount due upon the shares. Many of the proprietors, availing themselves of the power given them by the Act of Parliament, have paid up the whole amount of their call; and, if this had been done by all, it would have placed us in the position of being able to pay you sooner a dividend upon the whole amount. As it is, we only pay you interest upon the part which is due, and not upon the whole. I may state, as you will perceive the entire amount has not been made use of, that the reason for making the call all at once was, that a proposition was made to us, which, we thought, offered a favourable opportunity for the purchase of our works. The negotiation, however, went off, because the terms of the proposition were afterwards so altered, that we thought it was not at all worth our while further to entertain it. Had the terms first submitted to us been adhered to, we should have thought it advantageous to complete the purchase; and, I believe, the proprietors would have approved our doing so. At present, however, the matter has gone off; but I expect, some day, that wiser counsels will have weight with those to whom the property belongs, and then, perhaps, we may have another offer. Till that time, the question of purchase must remain in *statu quo*. With regard to the improvements of the works, the report, I think, fully states all the facts of the case. We believe what we have accomplished will be very beneficial to your property, and will assist us materially in the conduct of the business. With reference to the new tank, we have had some little difficulties; with which, however, I need not trouble you. All these matters must be met by the executive; and we need not go into them here. We have had the new tank leak; but the repair of the defect is now in a state of progression, and we have no doubt that, ultimately, it will be in a perfectly sound and satisfactory state. There is one thing which I am going to ask you to do. You will remember that, some time ago, you allowed us to take £50 a year towards our superannuation-fund. Since then, our works have much increased, and we have more persons employed upon them. We are now going to ask you to sanction our applying another £50 a year to the fund for the benefit of our workmen; and we have little doubt that you will agree to the proposal. With regard to the quality of our gas, the public, of course, are the best judges of whether we are supplying them well; and, in comparison with our neighbours, I believe our gas is as good as theirs. The inspector is perfectly satisfied with it; it is of higher quality than the Act of Parliament requires—and, I think, the same may be said of the gas now supplied by most of the metropolitan companies; so that, looking at the matter in the interest of the public, they have no reason to find fault with us. Gentlemen, I believe that is all I have to say to you. It is really almost a difficulty, on these occasions, to find topics to speak upon, because our affairs progress so smoothly; and I fear sometimes that we shall hardly have matters of interest enough to induce you to come to these meetings. But, for all this, I hope you will come, and for this reason—that, if we do not have a sufficient number of proprietors present to form a meeting, we cannot make a dividend; therefore, for your interest as well as for ours, I hope you will still make it your business to attend the half-yearly meetings of the company. I thank you for the attention with which you have listened to me, and I shall now be happy to hear any remarks the proprietors may have to make.

Mr. RHODES seconded the motion.

Mr. GRAY: It is scarcely necessary for me to make any observations at all. The accounts laid before us to-day are so satisfactory, and the results of the half year's working so gratifying to myself, as I am sure they are to the proprietors generally, that I am sure they will concur with me in the opinion that the affairs of the company are most admirably managed. My worthy friend in the chair has called attention to the negotiations which have taken place in reference to the purchase of the freehold of the works. There can be no difference of opinion as to the propriety of taking such a step, if the freehold could be obtained upon favourable terms. I do not know, however, how long the present lease has to run.

The CHAIRMAN: We have eighteen years more.

Mr. GRAY: It is perfectly obvious that, unless the freehold is purchased between the present time and the period when the lease expires, we may be liable to additional charges, which will very much interfere with the revenue of the company; and, therefore, I would press upon my worthy friend the necessity of the directors availing themselves of any suitable opportunity that may be afforded of buying the freehold, if it can be obtained upon suitable terms. With regard to the public service, there can be little doubt that the South Metropolitan Company are acting up to the spirit as well as the letter of the Act of Parliament. I believe all the companies are desirous of doing the same thing: and, though in some cases an addition has been made to the price of gas, the consumers are perfectly satisfied, because they feel that, though they are paying a slightly increased price, they are more than compensated by the higher illuminating power of the gas supplied. It is very gratifying to find this company in such a state of prosperity; and I have every confidence that whatever may be necessary to preserve that prosperity will be done by the directors. I cannot conclude without expressing my thanks to them for the satisfactory manner in which they have conducted the business of the company, and my hope that nothing will interfere to affect the present prosperity of our concern. I see that the £9281, which is the actual profit realized, is just sufficient to pay 5 per cent. for the half year. In addition to that, there is an undivided balance of £639, making together £9920, and leaving a balance, after paying the 5 per cent., of £607. My friend has expressed a wish that the contribution to the superannuation-fund should be increased from £50 to £100, and I am sure no one will have any objection to that; and, indeed, if a larger addition had been proposed, it would have met with the concurrence of the meeting. There is nothing which tends so much to make servants perform their duty as the knowledge that the directors have it in their power to do them some service when they most require it; and, therefore, I heartily support the proposition.

Mr. PAULL: I understood the chairman to say that the directors were only empowered to pay 10 per cent. dividend upon so much of the call as had been paid up, but that, if the shareholders had anticipated their payments, then they would have been able to pay dividends upon the whole.

The CHAIRMAN: The difficulty is this—we have now made the call, and therefore we cannot rescind the form of it. But, if it had originally been made in that way, I believe the Act of Parliament would enable us to do it, supposing all parties had paid up. We can now only pay interest upon the money paid in advance up to the time for the completion of the call.

Mr. PAULL: I am sorry it is not so, because I think we should all have been glad to anticipate our payments, and get 10 per cent. With respect to the purchase of the freehold of the works, I differ from the gentleman who has just spoken, because I presume that the extra capital raised by the call was fixed at a certain sum supposed to be sufficient to make the purchase at a certain price. Now, in the progress of time, and with the increase of population in our district, our business will doubtless increase, and this capital will be required; therefore, the more money you give for the freehold hereafter, the greater chance there will be of more money being called for upon which we shall get our 10 per cent. (Laughter.)

Mr. WHITLEY: May I ask whether, in assuming that the proprietors have been receiving 10 per cent. during the period in which the Act of Parliament allows back dividends to be made up to that amount, the bonuses we have received have been included?

The CHAIRMAN: I think we must say that you have had your 10 per cent. You have had it either in meal or malt.

The motion was then put and carried.

The SECRETARY read the following statement of profit and loss for the half year, and the balance-sheet:—

Dr. *Working the Establishment, for the Half Year ended June 30, 1862.* *Cr.*

To Gas rental—				By Management—		
Private	£25,168 2 1			Directors	£ 500 0 0	
Public	5,552 13 10			Auditors	31 10 0	
		£30,720 15 11		Salaries	1,000 16 0	
Residual products—				Commissions	463 13 5	
Coke	£6,290 5 3			Rent for office	469 6 3	
Breeze	176 4 8			Stationery, and general charges	729 12 3	
Liquor	330 5 6					£3,194 17 11
Tar	730 13 2			Manufacture of gas—		
		7,528 8 7		Coals	£13,022 7 0	
Sale of old materials		75 9 3		Supervision and labour	6,204 12 7	
Miscellaneous receipts		684 10 10		Tools and implements	250 10 0	
Balance of account at Dec. 31, 1861		639 4 2		Purifying and labour	497 13 7	
				Repairs and maintenance	1,138 8 9	
				Rents for works	460 13 8	
						21,574 5 7
				Distribution—		
				Mains	£2,430 2 10	
				Services	487 9 7	
				Sundries	313 2 8	
						3,230 15 1
				Meters—restoring, &c.	£ 974 9 11	
				Additional	361 3 5	
						1,335 13 4
				Bad debts and allowances		273 14 4
				Interest on capital in advance		118 4 9
				Balance		9,920 17 9
		£39,648 8 9				£39,648 8 9

Dr. *Balances, to June 30, 1862.* *Cr.*

To Capital		£186,267 10 0		By Works		£137,926 5 0
Reserve-fund		20,000 0 0		Freehold		10,532 10 3
Investment-fund		6,380 8 0		Amount due—		
Revenue account		9,920 17 9		For Gas	£12,327 3 1	
Unclaimed dividend		33 8 9		Coke	576 15 2	
Payments in advance		246 8 1		Sundries	585 7 0	
Amount due to sundry creditors		3,215 9 9				13,489 5 3
Meter depreciation account		789 16 9		Stock—		
				Coals	£4,274 9 3	
				Coke, &c.	51 7 0	
				Main-pipes	1,154 16 2	
				Service-pipes	278 0 2	
				Meters	776 1 0	
				General stores	445 17 3	
						6,980 10 10
				Consols for reserve-fund		20,000 0 0
				Ditto for investment-fund		6,283 0 2
				Investment—		
				New Three per Cent.	£13,000 0 0	
				Three per Cent. Reduced	915 0 0	
				East India debentures	6,886 5 0	
						20,801 5 0
				Bankers	£10,691 0 3	
				Cash in hand	150 2 4	
						10,841 2 7
		£226,853 19 1				£226,853 19 1

The CHAIRMAN moved—"That the accounts be received."

Mr. RHODES seconded the motion, which was put and carried.

The CHAIRMAN then moved—"That a dividend at the rate of 5 per cent. for the half year be now declared, and that the same be made payable at the company's bankers on and after the 10th inst."

Mr. GRAY seconded the motion.

The resolution was unanimously adopted.

Mr. GRAY: I have now much pleasure in proposing, "That the recommendation of the directors for increasing the contribution to the superannuation-fund from £50 to £100 be carried into effect."

The motion was put and carried, and a very cordial vote of thanks to the directors was also adopted.

The CHAIRMAN: Gentlemen, there is nothing more gratifying to persons in the position which we hold than to come amongst those who are the best judges of their conduct, and to receive from them the assurance that their services are appreciated. So long as we retain your confidence, and so long as we are able to preserve that good feeling which now pervades our meetings, that gratification will be ours, and you may depend upon it that our best exertions will be put forth to promote your interests and to secure your approval.

The proceedings then terminated.

GAS IN THE WEST INDIES.—The Burgher Council, representing the community of St. Thomas, West Indies, is desirous of receiving tenders from parties wishing to contract for lighting the streets of this town with gas. The tenders are to state the rate at which they will furnish the gas for 75, 100, 125, or 150 lamps, each to consume 6 cubic feet per hour; and the prices per cubic foot at which they will furnish gas for all other lamps required for public use. The contractor to furnish all materials, including lamps. The tenders to state the terms on which the works are to pass over into the hands of the public at the expiration of the contract, which is to last for either ten or fifteen years. The gas to be of the best quality. The town numbers about 12,000 inhabitants; and a lot of land, situate to the westward of the town, with a landing-place, suitable for the erection of the establishment, may be obtained, on moderate terms. Tenders will be received until Jan. 1, 1863.

ALLIANCE AND DUBLIN CONSUMERS GAS COMPANY.

The usual Half-yearly General Meeting of the Company took place, on the 29th ult., at the Offices, 114, Grafton Street, to receive the report of the directors and statement of accounts for the half year ending the 30th of June last, and to sanction the payment of a dividend thereon—THOMAS MICHAEL GRESHAM, Esq., in the chair.

The SECRETARY (Mr. Stevenson) having read the advertisement calling the meeting, proceeded to read the following report:—

The directors, in submitting their report and statement of accounts for the half year ending the 30th of June last to the proprietors, have again to congratulate them on the prosperous state of the company's affairs.

Following the course heretofore pursued, of comparing the accounts submitted to the meeting with those of the corresponding period of last year, it will be seen that the business of the company continues steadily on the advance. In revenue, there is an increase of upwards of £2000. In net profits, there is an increase of upwards of £5000, notwithstanding that the position of the company, in respect to charges or expenditure, is by no means so favourable as it was last year. For this, however, the board are not to be held accountable.

Owing to the revaluation of the company's rateable property, and the mode of assessment adopted by the Collector-General, the item of rent and taxes, which for the half year ending June, 1861, amounted to £655, stands in the present account at the enormous sum of £1285, an increase which they venture to state is out of all proportion with that imposed on any other description of property within the city of Dublin. Against this monstrous imposition the directors have struggled and expostulated in vain—the parties invested with the power of inflicting such grievous wrong having considered it becoming and consistent with their notions of right to oppose the efforts made by the board to obtain redress; and, having opposed them successfully—not on the law of the case, for that remains undecided—but on a mere technical informality—it only remains for them to submit patiently to the infliction for the present, and take such steps, in January next, as will, they trust, eventuate in a considerable diminution of a demand so unjust and exorbitant, as it affects the interests of the proprietors, and is so arbitrary and unreasonable on the part of those intrusted with such extraordinary powers.

During the past six months, the board have been actively and anxiously employed in the completion of the extensions alluded to in their last report. Three of the gasholders at the station have been reroofed and otherwise improved, and rendered more effective. The new retort-house has been completed, and considerable progress made in restoring the old one; while the additional coal-store, though not yet completed, will, they expect, be finished, and ready for the reception of coal by the end of next month.

In addition to these important improvements at the works, due attention has been paid to the extension and alteration of the mains, and due provision made for meeting public requirements both in the city and suburbs. Several miles of small have been replaced by large mains, including a 14-inch, from the works to Erne Street, which will enable your board to give a more abundant supply to Rathmines, while it will, at the same time, be attended with beneficial results in other localities, and more especially in the south-eastern district, where the demand for gas in private houses is steadily increasing.

Having thus briefly detailed the position and prospects of the company, it only remains for the board to direct the attention of the meeting to the accounts, and especially to the profit and loss account, which presents a net balance or gain of £5734 on the operations of the half year; from which they recommend the payment of a dividend of 6s. per share, free of income-tax, being at the rate of 7½ per cent. per annum.

Abstract of Revenue and Expenditure, Half Year ending June 30, 1862.

By Total revenue derived from gas and meter-rent	£20,136 2 8		
Sales of products, fittings, transfer-fees, &c.	6,148 18 1		
		£26,285 0 9	
To Value of coke, breeze, &c., on hand, Jan. 1, 1862	£ 175 16 2		
Coal carbonized	11,221 5 9		
Wages	2,255 12 3		
Salaries—board of directors	350 0 0		
Salary—secretary	250 0 0		
Salaries—officers and clerks	567 5 0		
Interest	130 17 6		
Charges	954 14 2		
Insurance	161 8 3		
Rent and taxes	620 4 8		
Stores—lime used in purifiers	166 13 4		
Wear and tear	1,965 3 9		
Bad debts, &c.	748 16 3		
New meters fitted	317 7 11		
Suspense account (half consolidated rates)	665 4 3		
		20,550 9 3	
Net gain		£5,734 11 6	

The CHAIRMAN, in moving the adoption of the report and statement of accounts, said he was happy to be able to congratulate the shareholders on the fair amount of success that had attended the affairs of the company during the past half year. A large sum had been expended in building gasholders, new boilers, and additional coal-stores. These would enable them to have, in future, about 10,000 tons of coal in store under cover, so that they could lay in their stock at the season of the year when freights were low, and when they could do so upon advantageous terms generally. Heretofore they had not sufficient storeage for so large a stock, and a large quantity of coals had to be left in uncovered spaces, exposed to the weather. (Hear, hear.) The amount of success that had attended them during the past half year was the more gratifying when they bore in mind that the city of Dublin had scarcely ever experienced a worse half year. (Hear, hear.) Trade had been depressed, and the shopkeepers had great reason to complain. The company had laid down a considerable extent of new pipes, and had replaced small pipes by large ones, which were required on account of the extension of business, which had increased far beyond their most sanguine expectations. Another gratifying fact to which he had to call their attention was, that both the debts due by the company, and the debts due to the company, had decreased. Last year, there was due to the company £26,665, and in June last it was reduced to £23,868, being nearly £3000 less; and this was at a time when there was great difficulty in collecting money, as he had learned from some of the tax-gatherers. There was also a reduction in the amount due to them for coke, the amount last year being £2657, and this year only £1577. These were very favourable facts. He hoped and believed the prosperity of the company would advance, and it would be materially aided if the shareholders would act upon the advice given them before, to exert themselves amongst their friends and neighbours to increase the business. The taxes payable by the company, he regretted to say, had been enormously increased this year; but he believed that, were it not for a mistake as to the notice, they would have succeeded in reducing the amount; but, for the next year, they would take care to be in a position to protect themselves. The Collector-General had availed himself of a technical point, and had not thought proper to allow the merits of the case to be tried and properly adjudicated upon. The increase was very heavy, and was calculated to interfere with the expectation of an increased dividend. He (Mr. Gresham) was in the chair on that occasion only as a deputy for their chairman. Sir Timothy O'Brien was, he regretted to say, not strong enough on his limbs to attend on the present occasion; but his clear and strong mind was as active and as powerful as others; and, as the secretary communicated with him on all matters of importance, the company had the benefit of his great experience and ability exercised upon a careful examination of the matters brought before him. After some further observations referring to the zeal and attention of the directors generally, the chairman concluded by moving the adoption of the report.

Mr. M'EVOY GARTLAN said he felt very great pleasure in seconding the motion. He was happy to find from the report that the movement made there twelve months ago had met with such excellent returns. They had not only the benefit of the services of the old crew, but the new hands put on board the ship had worked zealously and successfully. He congratulated the board and the company generally upon the success of that movement. There had been, he was glad to see, an increase in their income during the year; and, were it not for the enormous addition to their taxation, they would have a very considerable addition to their profits. He concurred in what had been said by the chairman as to the lamentable falling off in trade during the past half year. There was scarcely any one who had not felt this depression in trade. It was very creditable to the management of the company that, notwithstanding this condition of trade in the city, the amount of debts due to the company had been reduced. (Hear, hear.) With reference to the additional taxation, he confessed he did not think it was in good taste on the part of the board to have used against a public officer the harsh observations contained in the report respecting the Collector-General. He really thought that language less strong might have been properly used; but, while he was saying this of the language, he fully concurred in the principle that was expressed. He was satisfied that, whoever originated the additional taxation, did so from a strong sense of duty. He gave him credit for the best motives, although he concurred with the directors that the party had made a great mistake. He regretted the fatality as to the service of the notice of appeal. A little more caution might have prevented them being turned round on this point. But it would, in his opinion, have been more becoming in the public officer not to have taken advantage of that technical objection, and, instead, to have allowed a question of so much importance to the company and to the citizens to be fairly determined upon the merits. They would let him express a hope that, on the next occasion, there would be no mistake as to service of the notice of appeal, but that everything would be correctly done. On the question of dividend, he was one of those who did not think the present dividend a large one, having regard to the hazardous nature of their operations, and to the fact that they were their own insurers. The shareholders had a right to expect, and he hoped they would shortly get, a larger dividend. At the same time, looking to the unfortunate condition of the country—the want of trade, and the general commercial depression in the city, and, also, the great increase in their taxation—he should admit that 7½ per cent. was quite as much as the shareholders had a right at present to expect. But he looked forward to an increased dividend, and that was perfectly consistent with the expression of the fullest confidence in the present management—an expression in which he believed he was joined by every shareholder. He repeated, that the movement which took place was a right one, and he congratulated the company upon the fact that they had returned to their normal state of reciprocal confidence between the board and the shareholders, without which no public or private concern could be prosperous.

The CHAIRMAN said, a perfectly satisfactory explanation of the mistake as to the notice of appeal could be given. He promised that they would take care on the next occasion to be in a position to have the company relieved from this serious imposition.

The report was unanimously adopted.

On the motion of the CHAIRMAN, seconded by Mr. BOYCE, a dividend at the rate of 7½ per cent. per annum, free of income-tax, was declared.

Mr. D. FITZGERALD said, he felt great pleasure in moving the next resolution—"That the thanks of the proprietors be given to the directors, for their successful management of the affairs of the company."

Mr. P. O'BRIEN, M.P., seconded the motion, which was put and carried.

On the motion of Mr. BOYCE, Mr. Gresham vacated the chair, and the Lord Mayor was called thereto.

Mr. BOYCE moved—"That the thanks of the meeting be given to Mr. Gresham, for his conduct in the chair." He said, the attention which Mr. Gresham gave to the affairs of the company could not be exceeded. He discharged his duties well as a man of business and a gentleman.

Mr. GARTLAN seconded the motion.

The LORD MAYOR said, he could state with perfect sincerity that Mr. Gresham was well deserving of this vote of thanks at their hands. He was always at his post, and dealt with every subject which came before him in a fair and straightforward spirit.

The motion was adopted, and, Mr. GRESHAM having expressed his acknowledgments, the meeting separated.

STOREAGE OF PETROLEUM.

METROPOLITAN BOARD OF WORKS, FRIDAY, OCT. 3.

At the Meeting of the Board this day—J. THWAITES, Esq., in the chair,

Mr. PHILLIPS brought up the following report from the Streets Committee:—

In pursuance of the resolution of the board of the 11th of July last (No. 20), your committee have considered the question of the arrangements necessary to be made by the board for carrying out the provisions of the Petroleum Act; and have conferred with your solicitor and superintending architect as to framing some general rules and forms for that purpose. Your committee have bestowed much attention on the subject; and it appears to them that, as the buildings in which the petroleum is to be stored in the metropolis must vary with the quantity of material, and the locality of its deposit, and the precautions to be adopted must depend on the arrangement and distribution, as well as on the nature and construction of the premises, it will not be possible to lay down precise rules which shall be applicable to every particular case; but that it will be necessary to obtain from applicants, under the Act, an exact description of their store-rooms and warehouses, so that your superintending architect may report to your honourable board upon the merits of each individual application, as they from time to time arise; and they recommend:

That parties, in making applications for licences, under the Petroleum Act, be required to send in full particulars, together with a plan of the premises proposed to be used or adapted for the storing and safe-keeping of petroleum, with a view to each place being examined and reported upon by the proper officer of the board.

All which your committee beg to submit.

(Signed) J. THWAITES,
J. G. PHILLIPS.
E. COLLINSON,

Mr. PHILLIPS, in moving the adoption of the report, said he would not refer at length to the difficulties which surrounded the question. The committee had gone fully into them; and they felt that, however desirable at first sight it might seem to enact some general rules upon the subject, it would, in practice, be found far better to treat each application for a storeage licence upon its own merits, considering the peculiar circumstances of

the metropolis, and the extremely inflammable nature of the material to be dealt with.

Mr. D'IFFANGER seconded the motion.

Alderman LAWRENCE said the report referred to "the proper officer of the board" as the person to examine and report upon the proposed places of storeage. It would be well definitely to understand whether by that expression was meant the superintending architect.

The CHAIRMAN said he supposed it would be some officer in the architect's department.

Alderman LAWRENCE thought the superintending architect himself was the person to be held responsible for the advice under which the board should act.

Mr. PHILLIPS said the committee took that view of the subject, and would so recommend, unless the board should think fit to devolve the duty on some other officer.

Alderman LAWRENCE said, it ought to be clearly understood, because this was a most important matter. They were called upon to provide for the safe custody of a most inflammable article, and the utmost caution must be employed, not only to insure the fitting character of the premises themselves, but to prevent licences being granted for storing petroleum in thickly-populated neighbourhoods, where danger might arise to life and property.

The CHAIRMAN reminded the honourable member that the report stated, "it will be necessary to obtain from applicants, under the Act, an exact description of their store-rooms and warehouses, so that your superintending architect may report to your honourable board upon the merits of each individual application."

Alderman LAWRENCE said, great doubts had been thrown by some persons on the inflammable nature of petroleum and its products; but, he would state, for the information of the board, that a few days ago some experiments were made by an eminent chemist before the members of the Court of Aldermen, who were the local authorities under the Act for granting licences in the City of London. This gentleman was desirous of showing that petroleum or benzole, or whatever else it was called, was not so inflammable as was apprehended. He brought with him a sample of petroleum, and a sample of turpentine. The turpentine was put into a saucer and a lighted lucifer-match applied to it, the flame of which was immediately extinguished. When, however, the light was applied to the mineral oil, it blazed up most furiously. The experimenter expressed his surprise, and said he had tried the experiment repeatedly without producing any such result. He could only account for it on the presumption that the petroleum had got heated in his pocket. The fact showed the extremely inflammable nature of this material, and the importance of great caution in licensing places for its storeage.

Mr. R. TAYLOR was anxious to hear whether this board had control over all parts of the metropolis under the Act, except the City of London, because he happened to know that some of the parishes were making a move with regard to licences?

The CHAIRMAN said, the parochial authorities had no power to grant licences.

Mr. R. TAYLOR hoped the fact would become generally known, because some of the parishes regarding themselves as the local authorities referred to in the Act, were preparing licences to grant to individuals for storeage premises.

Deputy HARRISON said, if the statement of the honourable member was correct, the sooner the parties were put right the better, and, perhaps, it would be well to hear the solicitor on the subject.

Mr. SMITH (the solicitor) said he did not think it possible that a question could be raised on this point. The Act of Parliament said, "The following bodies shall respectively be the local authority to grant licences under this Act in the districts hereinafter-mentioned—*i.e.* in the City of London, except as hereinafter-mentioned, the Court of Lord Mayor and Aldermen of the said City. In the metropolis, as defined by the Act of the session of the 18th and 19th years of the reign of her present Majesty, c. 120, except the City of London, and except, as hereinafter-mentioned, the Metropolitan Board of Works."

Mr. ROBINSON said there was a passage after that which referred to local boards which had better be explained.

Mr. CARPMAEL said that passage referred to districts beyond the metropolis.

Mr. COLLINSON, as a member of the committee to whom the subject was referred, concurred in the recommendation that each case should be dealt with on its own merits: but, he thought the superintending architect should, on every application, report whether the building proposed for the storeage of petroleum was detached, and at what distance it stood from surrounding buildings. He felt that this was very important, because, though the arrangements of the building itself might be in every respect satisfactory, it might be unwise to grant a licence where there were houses or warerooms in the immediate neighbourhood exposed to danger in case of fire or explosion.

Mr. SAMUDA, representing a district from which numerous applications might be expected, thought the recommendation of the report was insufficient. The board ought to lay down some general rule to prevent the necessity of discussing and adjudicating upon each individual case. There were no less than four or five cases from Poplar now before the board, in which parties sought for licence to store petroleum, and he had received two or three letters from the owners of neighbouring premises, begging him to do all in his power to prevent the sanction of the board being given to the applications. His correspondents represented, with a great deal of reason, that the effect of storing this dangerous commodity in proximity to their premises was to expose them to a very considerable risk, and that in the event of fire or explosion there was no means whereby they could obtain compensation for the loss they would sustain. The board ought to frame a standing order that, under no circumstances should an application be entertained when the premises desired to be licensed were within 30 feet of other buildings.

The CHAIRMAN said, the committee were extremely anxious to lay down some such rule, but they felt there was a difficulty in doing so, and that difficulty was increased by the fact that the Act came into operation on the 1st of October. They were desirous to feel their way a little, and therefore considered it better that every case should be distinctly brought before the board, to be dealt with on its own merits. By-and-by, no doubt, as the result of the experience thus gained, it would be possible to frame a general rule for their guidance in these matters.

Mr. NEWTON said the whole of the points referred to by preceding speakers had been before the committee, and the superintending architect had prepared a report as to what buildings should be licensed. Mr. Samuda's objection was already provided against by the Legislature. The third section of the Act declared that, "from and after the 1st of October, 1862, not more than 40 gallons of petroleum shall be kept within 50 yards of a dwelling-house, or of a building in which goods are stored, except in pursuance of a licence given by such local authority as is hereinafter mentioned." It appeared to him that this section of the Act showed what should be the policy of the local authority; and it could not be doubted that this board would be guided in the exercise of their discretion by the fact that Parliament deemed it unadvisable to permit the storeage of this inflammable material in close proximity to other buildings. It would, however be unwise to lay down, as a general rule, that 50 yards should be the exact distance at which, under all circumstances, such stores should be allowed; because 50 yards might be a very unsafe distance in some circumstances, and 100 yards in others. It would be much better to examine each case as it arose, by the proper officer appointed for the purpose. The additional duty which it would impose would not be very great, because the number of applications for the storeage of large quantities of petroleum would be comparatively few—probably not more than forty or fifty—as parties keeping it for retail purposes would not be likely to have such a number of gallons on their premises as to require a licence from the board. As to Alderman Lawrence's remarks, he could assure the honourable member that the committee had fully considered the dangerous character of the material, and were quite alive to the necessity of proper precautions in dealing with so hazardous a commodity.

Alderman LAWRENCE said it was quite clear that, at the present moment, the board did not know fully the extent of the applications that would be made to them. Pending further information on that point, he thought they ought to determine that no licence should be granted for a longer time than one year.

Mr. FREEMAN, in reference to the remark of Mr. Samuda, said he thought the board should not encumber themselves with rules upon points for which the Act of Parliament had definitely provided. The distance at which petroleum stores might safely be placed from other buildings had engaged the attention of the Legislature, and the general principle that not more than 40 gallons should be kept within 50 yards of a dwelling-house or building in which goods are stored might be judiciously acted on until experience should justify the board in modifying that regulation.

Mr. BENNETT hoped the suggestion of Alderman Lawrence would not be lost sight of, because what was a proper place in October, 1862, might be a very unsuitable one at the same period in 1863. Whatever licence, therefore, was granted should not extend beyond the time when altered circumstances might render its longer continuance dangerous for the protection of the public. With regard to petroleum stores being at the distance of 50 yards, if that provision were strictly carried out, it would amount to a prohibition in the metropolis, as it would be next to impossible to find a place suitable in other respects, and so situated, He would move—"That in no case will this board grant licences for the storeage of petroleum to extend beyond twelve months."

Mr. H. L. TAYLOR said, he apprehended that such a resolution would be contrary to the Act of Parliament. It ought not to be within the power of the board, after granting a licence to a party who had laid out large sums of money in providing suitable premises for the storeage of petroleum, to revoke that licence. The public would not submit to be so controlled, and it would not be the policy of the board to adopt the suggestion. It was all very well to act with care and caution, and, if the Act of Parliament had said nothing about 50 yards, it would perhaps be proper to say they would only grant licences for a certain term.

The CHAIRMAN asked, whether the Act of Parliament did not point out that the jurisdiction of the board only arose when parties were desirous of having a storeage within 50 yards, and that, without licence, they could store petroleum in a building erected beyond that distance?

Mr. H. L. TAYLOR, assuming that to be so, argued that the recommendation of the committee to deal with each case as it arose was the best course for the board to pursue. With reference to the terms of that recommendation, he thought it would be better to substitute the words "the superintending architect" for "the proper officer." The board had confidence in Mr. Vulliamy as their superior officer, and it would be right to leave the responsibility in his hands.

The CHAIRMAN said that it would be only carrying out the views of the committee if the substitution of those words took place, as was evident from the whole tenor of their report.

Deputy HARRISON supported the recommendation, which would leave the board at liberty, in every case after the premises were examined, to grant licences on such conditions as they saw fit. He opposed the suggestion for limiting the duration of such licences to twelve months, as, with such a limitation, parties would not be willing to lay out their money in providing suitable places for the safe custody of petroleum.

Mr. CARPMAEL said, according to his view of the Statute, the board had no power to make such a limitation. Their jurisdiction did not arise until a party required to store a larger quantity of petroleum than 40 gallons, in premises within 50 yards of a dwelling-house, or of a building in which goods were stored. They must deal with an application for a licence under those circumstances as it arose, and it was impossible to lay down a rule previously upon the subject. The superior courts had decided in a case which came before the Wandsworth District Board, that this must be the course taken in carrying out the provisions of another Act of Parliament, and that the local authorities were liable to a mandamus if they did not do so. Under the Petroleum Act, if this board refused to grant a licence, the party applying could, within ten days, call upon them for a certificate as to the grounds upon which that refusal was based, and, thereupon, make application to the Secretary of State for the Home Department, who, upon inquiry, had power to grant a licence, notwithstanding the refusal of the board. Under these circumstances, they would be taking the only prudent course by adopting the recommendation of the committee.

After some observations, in reply from Mr. PHILLIPS, the motion, altered as suggested, was put and carried.

The board afterwards proceeded to receive the superintending architect's reports upon applications for licences. The first case was that of Mr. Greeve, for licence for storeage at **Alpha Wharf**, Millwall, Poplar, the consideration of which was adjourned to obtain corrected plans and particulars.

The SUPERINTENDING ARCHITECT presented the following report upon an application by Mr. D. E. Timothy, for Timothy and Co., for licence of premises at Mellish's Wharf, West Ferry Road, Millwall.

This being the first application for a licence from this board, "for the safe-keeping of petroleum, and certain products thereof that are dangerous to life and property, from their properties of giving off inflammable vapours at low temperatures," it appears desirable to enter rather fully upon the subject, in order that the future practice may be, as far as circumstances will permit, uniform.

Various rumours are abroad as to the danger of petroleum. By some it is magfied to a fearful extent, whilst others regard it as only a little more dangerous than turpentine, or similar inflammable liquids. But, at any rate, the Legislature has thought fit to pass the Act, and it must be carried into effect with every care that the intention of the Act should be fulfilled.

Messrs. Timothy's premises are shown, though not quite correctly, on the accompanying plan. They extend from the river to the West Ferry Road, 457 feet, with a river frontage of 135 feet 9 inches, but less by one-fourth next the Ferry Road. The buildings, with the exception of those marked R and S, are brick-built and substantial; and it is in most of those coloured blue that petroleum in casks is stored to a large extent, there being between two and three thousand barrels of from 22 to 26 gallons each already on the premises; and it was stated at the survey that there is room for nearly four times the quantity when the buildings R and S are used, and the others more closely packed.

In April last, in consequence of an earnest representation from the fire offices, the Secretary of State for the Home Department ordered that these premises should be inspected, to ascertain what additional caution should be taken to render them secure, as against the spread of fire; and Mr. H. A. Hunt, surveyor to the office of Her Majesty's Works and Buildings, made an inspection and report, the substance of which was, as I understand, that the outer walls in many places should be raised, and that some new sheds (T and P on plan) should be so constructed as that the surface-level inside should be 2 feet lower than that outside; and that the sheds on the sides next the premises should be open from about 4 feet above ground, and the roof slated or tiled. All these suggestions have been carried out, and the parapet-walls next the two adjoining premises carried up several feet higher than the gutters; whilst, in one portion, a wall, without any building against it, has been built 30 feet high. Most of the stores are lofty and well ventilated, and every care is said to be taken that no lights or fire be used in any part of the premises approaching the stores. It should be mentioned that the ground falls several feet from west to east; so that, in the event of a fire the casks should burst, the flow of the liquid would not be likely to endanger any shipping in the Thames, but might probably run into the public thoroughfares, and get into the sewers.

Mr. Timothy's neighbours, Messrs. Fenner on the south, and Messrs. Burney and Bellamy on the north, are apprehensive on account of his large storeage, and complain that their insurances are affected. Messrs. Fenner state that they are bound to insure under forfeiture of their lease, but have received a letter (which is now in the office) from the Royal Insurance Company, declining to continue their policies after Michaelmas last, and they strongly urge this board not to license Mr. Timothy's premises.

With regard to the precautions suggested by Mr. Hunt, I consider that Mr. Timothy has properly carried them out. As far as they go, they are no doubt very excellent provisions for keeping ordinary fire within the premises, should no wind be up; but, if with a quantity of petroleum running about, it blew from the north, nothing could save Mr. Timothy's premises, where resin and pitch are largely stored; and if, from the opposite quarter, those of Messrs. Burney would be sacrificed, as well as others adjoining.

From all that I can collect on the subject, the great danger is in the petroleum getting loose from the bursting of the casks when a fire happens, and it has occurred to me that one great point in its safe-keeping would be to provide against that contingency. This I would propose to do by requiring that the casks should be stored in constructed basins or tanks, either of iron or brick, sunk two or three feet below the ordinary ground-level, and of such capacity as to contain all the liquid, allowing of course for the displacement occasioned by the casks, and for six inches at least below the top of the basin. A mere shed over all with a projecting roof would be all that is necessary for shelter from the sun and weather, taking care where such shed adjoins other property, or another store, that sufficient brick walls, without openings, be erected. This expedient, though costly in the first outset, together with a sufficient height of boundary-wall would, I believe, be very effectual in arresting and keeping a fire within bounds, provided the wind was not adversely high.

The question, however, arises, as to what course to pursue in regard to the application made by Mr. Timothy, for if the Legislature has considered it expedient to make the Act apply to so small a quantity as something over 40 gallons, it seems clear that more than ordinary caution should be taken when, as in the present instance, probably more than 50,000 gallons are concerned, and four times that quantity could be stored.

It seems desirable that a limit should be fixed to the quantity to be stored on the same premises, as well as to the time over which the licence should extend.

My opinion is that in several of Mr. Timothy's buildings a moderate quantity of petroleum may be safely kept; as those, for instance, where the surface of the ground is sunk—namely, the cellar next the pathway, and those marked P and T, which alone would contain several hundred casks, in single layers; but I much doubt the expediency of allowing them to be piled up three tiers, as is the case in parts of these premises, unless, as I have suggested, a sunk reservoir be constructed, capable of containing, without overflow, the contents of the casks stored therein.

I have dealt fully with this case, as the board's determination upon it will elicit a principle of action with regard to many others.

(Signed) GEORGE VULLIAMY,
Superintending Architect.

Mr. PHILLIPS asked the superintending architect what depth below the surface of the ground he would recommend the tanks to be sunk?

Mr. VULLIAMY said, that would entirely depend upon the quantity of petroleum to be stored.

Mr. CARPMAEL said the recommendation was that the cubic contents of the reservoir below the ground-level should be as large or larger than the quantity which could flow into it.

Mr. PHILLIPS said subsequent reference was made to piling the casks. It appeared to him exceedingly desirable that this should be prohibited, as it would be more likely that the temperature of the petroleum would be increased if the casks were piled than if they were kept separate.

Mr. VULLIAMY said his impression was that there would be no harm in piling the casks 20 feet high, provided the reservoir was of sufficient dimensions to contain the whole of the liquid, and the material of the casks, in the event of accident. It was impossible to prevent persons burning their own premises; the object of these precautions was to prevent fire extending to their neighbours. The reservoir, he thought, might be covered by a corrugated iron roof.

Mr. CRELLIN was desirous that the architect's report be referred to the Streets Committee to examine. It might be that the committee would think it right to allow a certain quantity of petroleum to be stored upon the premises in their present state.

Mr. CARPMAEL thought it would be well to obtain the opinion of the solicitor, as to whether it was necessary for applicants for licences to attend before the board, or whether the applications might come in the present form. There being an appeal against the refusal of the board to the Secretary of State, if the applicants were dissatisfied, it was desirable they should know in what manner the board should hear cases, and give their decision upon them.

Mr. SMITH said, the question was an important one. The Act of Parliament certainly pointed out no particular form of application, nor any precise mode in which the board should express its determination or judgment. A power was given to the Secretary of State to grant a licence if he saw fit after the board had refused, but no formality was prescribed, either in the fifth or sixth section, as to the mode of granting or refusing licences. No doubt it would be most convenient, in practice, that the application made to the board should be a formal one, and should be recorded together with the reasons for the board's decision upon it, as they would then have a business-like document to lay before the Secretary of State, upon which he could conveniently and promptly act, if called upon to review their judgment.

Deputy HARRISON said, the importance of this matter could not be overrated, and he would, therefore, move—"That the report of the superintending architect be printed and circulated among the members of the board, together with a plan of the buildings in question; that the further consideration of the application be adjourned until next Friday, and that, in the meantime, the matter should be considered by the Streets Committee A week's delay would not be of serious consequence, and the board would do well to initiate their proceedings under the Act with great caution.

Mr. SMITH reminded the honourable member that the applicants were exposed to heavy penalties for every day during which petroleum was kept in unlicensed premises, the Act of Parliament having come into force on the 1st inst.

Mr. CARPMAEL said, notwithstanding that, the board must not be hurried into a decision on an important point like this.

The CHAIRMAN asked Mr. Vulliamy if he was aware whether there were any sewers or drains in connexion with the applicant's premises, through which, in case of fire, the petroleum could find its way into the river, and thus endanger the shipping?

Mr. VULLIAMY said, that was a matter he would look into.

Mr. NEWTON thought that the local board of the district should be applied to for information on that subject.

Mr. COLLINSON said, if the sunk reservoir were of sufficient capacity as recommended, there would be no danger of such a calamity.

Alderman LAWRENCE urged that all the applications should be read before any decision was arrived at. The board would probably then be able to lay down some general principle.

Mr. FREEMAN objected. The application now before them was to license a building for an immense storeage, and there were grave considerations in connexion with it. The petroleum appeared to be stored in casks, which were piled in three tiers, and, if the upper ones caught fire, the temperature of the others would be so much increased that a fearful explosion might result, endangering all the property around.

The CHAIRMAN, admitting that the board should act with deliberation, and not be hurried into a premature decision, reminded the board that the penalties under the Act were very severe. By reference to the 3rd section, it would be found that, from and after the 1st of October, any petroleum kept in contravention of the Act was to be forfeited, and the occupier of the place in which such petroleum was kept incurred a penalty of £20 a day during its continuance on unlicensed premises.

Mr. ROBINSON did not think any magistrate would impose the full penalty in any of the cases before the board, seeing that the applications for licences were made before the time at which the Act came into force.

Mr. CRELLIN recommended that the members of the Streets Committee should view the premises, which would enable them to form a judgment as to the eligibility better than all the plans that could be submitted. When once the decision of the board as to the kind of building they would sanction was made known, it would be easy to deal with future applications.

After some further conversation, the motion of Deputy Harrison was put and carried.

The next application was from Messrs. Braithwaite and Tringham for oil stores in Cross Street, Finsbury.

Mr. VULLIAMY reported that the licence sought was to keep petroleum in casks in a vault 80 feet long and 18 feet 6 inches wide. Over the vault was a stable, and the only access to it was by cellar-flaps. Gas was burned in the vault, and the only ventilation was when the flaps were open. It was intended to keep ten casks or about 400 gallons of petroleum in the vault. He recommended the board not to grant the application, as it was undesirable to sanction the storeage of such a material in vaults beneath houses or other buildings.

Mr. LE BRETON moved that, for the reasons stated by the superintending architect, the licence be not granted.

Alderman LAWRENCE seconded the motion, which was spoken to by Messrs. Peckett and Phillips.

Mr. BENNETT moved, as an amendment, that the licence be not granted, without assigning reasons for the refusal.

Mr. ADAMS seconded the amendment, because the decisions of the board were not arrived at with closed doors, and the applicants had the opportunity of being present, to know the grounds upon which they acted.

The CHAIRMAN said, in cases where there was an appeal to a superior court, the court below usually assigned reasons for their decision. In some instances, the parties, knowing the grounds of objection, might be able to effect such alterations in their premises as to make them suitable.

The motion and amendment gave rise to some discussion, but ultimately the former was carried by a large majority.

Messrs. Spackman and others, on behalf of the shareholders of the Asphaltum Company, Limited, applied for a licence for their premises at Millwall, Poplar.

Mr. VULLIAMY reported that the premises were next but one northward of Messrs. Timothy. On the wharf where the petroleum was landed, was a small well, into which the casks were emptied. The oil flowed by underground stone pottery pipes to several sunk tanks, three of iron and one of brick, of capacity sufficient to hold 7000 gallons. From these tanks, the oil was pumped up for the distilling process. Various other operations were carried on there. Messrs. Burney and Bellamy objected to the granting the licence, as they had great difficulty in insuring their premises in consequence of this store—some offices declining altogether, and others requiring an additional premium. His opinion upon the application was, that there was not more than the ordinary danger in storing and working the oil; but he considered it desirable that certain wooden walls and enclosures next the chemical works should be altered before the licence was granted. With regard to the other arrangements, they were very perfect—the tanks were all below the surface of the ground.

On the motion of Mr. COLLINSON, the further consideration of the application was adjourned for a week.

Messrs. Price and Co. applied for a licence for stores of Rangoon earth-oil at West Ferry Road, Millwall.

Mr. VULLIAMY reported that Messrs. Price had for many years stored and worked large quantities of that material; and, in accordance with the recent Act of Parliament, they presumed that the licence of this board would now become necessary. This case appeared to him to differ from the others under consideration, inasmuch as from the analyses and reports of Dr. Letheby, Professor Taylor, Mr. Keats and Dr. Penny of Glasgow, Rangoon earth-oil did not fall into the category of American or Canadian petroleum, because it did not evolve inflammable gas at a temperature less than 100° Fahr.; nor were its products so easily inflammable as those of ordinary petroleum. The premises of Messrs. Price had been surveyed, and if the board were satisfied, from the reports of the eminent chemists, that there was no extraordinary risk in storing and working this particular oil, he saw no reason for refusing the licence, which should specially apply to Rangoon earth-oil and no other.

Mr. SMITH, on being referred to by some of the members said Rangoon earth-oil did not come within the Act, unless it met these conditions—"'Petroleum,' for the purposes of this Act, shall include any product thereof that gives off an inflammable vapour at a temperature of less than

100° of Fahrenheit's thermometer." From the reports cited, Rangoon oil did not evolve such gas at less than 200°.

The CHAIRMAN said, the Act having laid down a basis for the jurisdiction of the board, it would be little less than impertinence to interfere in such a case as this.

Mr. FREEMAN said that would depend entirely upon the correctness of the reports referred to. Some persons were of opinion that Rangoon oil did evolve inflammable gas at a much lower temperature. He moved that the application be referred to the committee.

Alderman LAWRENCE said Messrs. Price, having been engaged all their lives in operations with oil, were well qualified to judge whether their works came within the requirements of the Statute; and would not have made the application unless they saw a necessity for it.

Mr. CARPMAEL said Rangoon oil had only been before the public for the last four or five years. When distilled at a low temperature, its products were extremely volatile and inflammable. The board ought to be informed whether Messrs. Price stored any other products than those upon which the chemists named had reported.

Mr. LE BRETON asked whether, if the matter were referred, the committee would have power to call in the assistance of those chemists?

Mr CARPMAEL said it was no part of the duty of the board to do so.

The application was then referred. There were two other applications, the consideration of which was adjourned for further information.

METROPOLIS GAS SUPPLY.

CITY COURT OF SEWERS, GUILDHALL, TUESDAY, SEPT. 23.

At the Meeting of the Commissioners, held this day—Mr. DE JERSEY in the chair,

Dr. LETHEBY presented his report upon the illuminating power and chemical quality of the gas supplied by three of the companies to the City of London, as follows:—

To the Honourable the Commissioners of Sewers of the City of London.

Gentlemen,—I have the honour to submit my report of the illuminating power and chemical quality of the gas supplied to the City of London during the summer quarter, by the Great Central, the Chartered, and the Commercial Companies. The experiments have been made at two places—viz., at the laboratory of the London Hospital, and at the laboratory in Finsbury Square.

Altogether, there have been made 424 examinations of the gas—viz., 308 of the Great Central, 77 of the Chartered, and 39 of the Commercial. The results are as follow:—

The mean illuminating power of the Great Central has been equal to that of 12·61 sperm candles of the standard consumption; the Chartered, 12·85; and the Commercial, 14·02. Taking the weekly average of each company, the Great Central has been but once below the standard, and that only to the extent of 0·13; the other companies have not been below it.

The gas has at all times been free from sulphuretted hydrogen, and has contained only traces of ammonia. (Signed) H. LETHEBY.

Mr. SAUNDERS inquired how many examinations of the gas had been made during the periods of from one to three o'clock in the morning?

Dr. LETHEBY said his experiments extended as far as to half-past twelve at night; there were none made after that hour.

Mr. SAUNDERS said he had made the inquiry, because he was certain that, in some form or other, the gas companies did reduce the illuminating power of their gas at two or three o'clock in the morning. He thought it would be extremely satisfactory to their fellow-citizens, if the commission would for a short time appoint a person of talent to test the gas at uncertain intervals during those hours.

Mr. C. YOUNG said he was very sorry to find that Mr. Saunders was in the habit of being out of doors at such unreasonable hours, that he was able to speak of the illuminating power of the gas between two and three o'clock in the morning. For his own part, he thought the court should be satisfied with the testings which Dr. Letheby was accustomed to make.

Mr. SAUNDERS said his knowledge of the state of the gas at the time he referred to arose from this circumstance, that he was sometimes professionally engaged in his office all night, or till a very advanced period of it; and he found that, about half-past one, the gas from his telescopic burner began to give a strong yellow light.

Mr. YOUNG supposed this appearance arose from the fact that the honourable commissioner began to get sleepy at that time.

Mr. SAUNDERS denied that such was the case. Sometimes the gas went quite out, and he was obliged to have recourse to an oil-lamp which he kept in his office ready for such a contingency. He was convinced there was something wrong, because the same complaint had been made about the gas in the public lamps. Mr. Fricker (a commissioner) told him that, having occasion to pass through St. Paul's Churchyard early one morning, he observed that the lamps were not giving a proper light. He inquired of a policeman whether that was the general condition of things, and was answered, "Yes; it is usually so at this time in the morning." Now, if there was nothing in these complaints, it ought to be so stated on official authority; and, if there was, something should be done to remedy the evil.

Dr. ABRAHAM asked Dr. Letheby whether he was in the habit of testing the pressure as well as the illuminating power of the gas?

Dr. LETHEBY said he was, and should be quite in a position to give the details of his experiments.

Dr. ABRAHAM asked the medical officer to inform the court what the average difference was between the pressure at one o'clock in the morning and nine o'clock at night.

Dr. LETHEBY: I dare say the pressure is about half.

Dr. ABRAHAM said, that statement just accorded with the remarks made by Mr. Hughes, in a recently-published document. Mr. Hughes stated that, in the winter season of the year, the greatest pressure was from six to eight in the evening; that then it gradually diminished to ten o'clock; that at twelve there was a further very great diminution; and from about half-past twelve to one there was only about half the pressure that there had been at seven o'clock in the evening. This was a very important matter for the commissioners to know; because, if they entered into contracts for a supply of gas to the public lights, and supposed that they had got a pressure all the way through the night by which they would secure a consumption of 5 feet per hour, they would be much mistaken; because the pressure, as stated by Mr. Hughes, being so much reduced, it was clear the supply at one o'clock in the morning did not amount to more than 3 feet per hour. When the commission came to burn by meter—as he hoped and trusted they would—he was confident they would not only save by it, but it would be more satisfactory in every way. They would then find out how they had been bamboozled by the gas companies for many years past. The document to which he had referred was a most important one, and the commission might learn much from it. He did not know whether the court would like to go to the expense of purchasing and sending a copy to each member.

Mr. SAUNDERS: What is the price of it?

Dr. ABRAHAM: I do not know. It was sent to me by Mr. Hughes.

The CHAIRMAN: I think the place for testing the gas will be ready in a month or six weeks, and this matter will be then gone into. It is desirable that it should stand over till then.

Mr. YOUNG inquired whether Dr. Letheby had inspected the premises of Messrs. Hadley, where, as reported last week, a fire had occurred through the manufacture of gas being carried on there?

Dr. LETHEBY said he had not.

Inspector Painter said Messrs. Hadley had erected their furnace against a party-wall, and the heat had ignited the woodwork of a dwelling in the rear. That furnace was now being pulled down, and another one erected at a distance from the wall.

TUESDAY, SEPT. 30.

METERS TO THE PUBLIC LAMPS.

At the Meeting of the Commissioners, this day,

Deputy HARRISON asked the engineer whether he had any report to make upon the result of his experiments in placing meters to some of the public lamps?

Mr. HAYWOOD said, he was not prepared with a report at present. The experiments had only just commenced, and it would be a fortnight or three weeks before he would be in a position to give any results. When the court decided that the experiments should be made, it was necessary to have the meters made.

Dr. ABRAHAM said the application of meters to the public lamps was not a new thing at all, but was a matter which had been experimented upon for years. In several large provincial towns—for instance, at Plymouth, St Ives, and Leicester—the local authorities had been purchasing their gas by meter for the last seven years, and had effected a considerable saving thereby. At Worthing, by an arrangement with the gas company, a meter was fixed to every twelfth lamp, both parties being content that the consumption of the remaining eleven should be determined by the recorded results in the one. If anything like that arrangement could be come to between the commission and the gas companies supplying the City of London, he was persuaded it would be very advantageous. He took the opportunity of stating that, at the next meeting of the court, or the one following, he intended to submit a motion upon the whole question of the supply of gas to the City.

Deputy HARRISON said he did not know why, as the commissioners had gone to the expense of having meters attached to some of the public lamps, they should not at once have some report upon the subject. He was averse to the notion of having to wait for a long time before the results of the experiments were made known. Week by week, the commission should have those results laid before them in a tabulated form. He did not doubt that the commission had all that they paid the gas companies for; but it would be more satisfactory to know for a certainty that such was the case; and, unless there were any objections to such a course, he would move that the engineer be requested to furnish such a return as he had named at each meeting of the court.

The CHAIRMAN said it would be, perhaps, better to hear what the engineer had to say upon the subject, before moving such a resolution.

Mr. HAYWOOD said the question of the propriety of placing meters to the public lamps was referred to a committee, who reported to the commission that the experiment should be tried. The commission then instructed him to undertake the work, which he accordingly did. The first thing necessary to be done, was to determine the best sort of meter to employ for the purpose. He had had several descriptions submitted to him; and, having fixed upon the one which he considered the best, the meters had to be made. This, of course, consumed some time; but the meters were now all fixed. Several of them had been in operation for two or three weeks. The results were taken, not every week, but every day, in various parts of the City; and he could lay those results before the commission, if it was thought desirable, but not in a digested and tabulated form. It appeared to him that to do so before some more general results were obtained, would be to defeat the object of the experiments. As yet, he could only give them a mass of crude information; but he hoped, in the course of a fortnight or three weeks, to be able to bring up a satisfactory report on the subject.

Deputy WHITESIDE: How many meters have you applied to the public lamps?

Mr. HAYWOOD: I think at the present moment there are about thirty-six meters in different parts of the City, and they are watched by night and by day.

Deputy ELLIOTT: Is it supposed that by these meters you will be able to determine the consumption of gas in all the public lamps of the City?

Mr. HAYWOOD: At present I have only the results in a general way, but have not formed any judgment upon them, nor am I prepared to give you any advice upon the matter. If you instruct me, I will do so; but I think you should allow me time to conduct the experiments further so as to come to a just conclusion, and then I will lay a report before you.

Deputy LOTT: We pay for the public lamps so much each per annum, do we not?

Mr. HAYWOOD: You pay so much per lamp for a given quantity of gas. One of the objects in applying the meters is to ascertain whether the proper quantity of gas is consumed or not. But there is also another object in connexion with the carburetting process—viz., to ascertain, in cases of defective lighting, whether the fault is due to the carburator or to a deficiency of gas.

Deputy LOTT: But you have no means of showing by the meters what sort of naphtha is put into the cans.

Mr. HAYWOOD: No; but there is an examination made whenever there is a return of a deficiency of light. Returns are made to me by the police, and the same day the carburators are examined.

Mr. C. YOUNG: Under whose control are the meters?

Mr. HAYWOOD: They are entirely under my control.

Deputy HARRISON: I will move that the matter stand over for three weeks, but I cannot conceive that there is any difficulty about making the return.

Mr. HAYWOOD: There is no difficulty about it; it is only a question of expediency.

Deputy ELLIOTT did not think it was desirable the matter should stand over; but, in experiments of this kind, which involved delicate operations, it would be better perhaps to leave the result in the hands of the engineer. At the same time, he must say that he did not think with so few meters they were likely to obtain any very satisfactory information. The gas companies could easily arrange to turn on less gas to those lamps which had not the meters attached. He had no confidence in the honour or the honesty of the companies, and he thought that the commission to obtain full satisfaction ought to have a meter to every one of the lamps.

PRIVATE GAS-WORKS.

Mr. C. YOUNG said, on a former occasion he called attention to the erection of gas-works in Earl Street, and, in the course of their proceedings at that time, it was reported that a fire had taken place in consequence of the manufacture there carried on. Since then, he had been informed that another fire had occurred. He would, therefore, now move that Dr. Letheby be requested to visit those works, and examine and report upon the operations there conducted. He thought that the fact of two fires occurring within one month was quite sufficient to justify the court in taking some action in the matter.

Dr. LETHEBY said, he should ask that the engineer be associated with him in the inquiry, as Mr. Haywood's knowledge about the construction of furnaces was greater than his own.

Mr. YOUNG then moved that the matter be referred to the engineer and medical officer.

Deputy HARRISON opposed the motion. This was the second time the question had been brought before the court. On a former occasion, a letter was received, calling attention to the existence of the works of Messrs. Hadley, on account of the supposed danger to the inhabitants and the neighbourhood. The honourable member then moved that it be referred to the engineer and medical officer, and his motion was negatived. Under those circumstances, it was hardly doing justice to the commissioners who were present at that discussion, for the honourable member to get up at the end of a day's business, and move his resolution over again, without some notice of motion. On the point of order, he believed it was not competent for him to do so. But he would put it upon totally different grounds, and say that the court ought not to adopt such a resolution, and that it would be unwise to interfere in the matter unless they were prepared to undertake a responsibility which was not within their jurisdiction. He would, however, first submit to the chairman that the former resolution, having been negatived by a large majority, he ought now to rule that this motion, of which no notice had been given, could not be put.

Mr. C. YOUNG said, when he made his motion originally, he was not aware that there had been a fire. He thought the facts subsequently ascertained called for the interference of the court.

The CHAIRMAN: What is the object of the resolution? It is a question whether, supposing there is any danger, we have the power to interfere.

Mr. C. YOUNG: I apprehend it is a dangerous manufacture, but I will not press the motion.

THE CARBURETTING PROCESS.

Mr. HAYWOOD reported that he had received a letter from the United Kingdom Carburating Company, asking for a further payment on account of their contract.

The letter was referred to the General Purposes Committee.

WANDSWORTH DISTRICT BOARD, WEDNESDAY, SEPT. 24.

Mr. F. W. BEAUMONT (the gas examiner) read a report upon the gas supply. It stated that the illuminating power of the Phœnix Company's gas was, on the 10th inst., equal to 15¼ candles; and on the 14th, to 14·28 candles. The gas was rather ammoniacal, and there had been recently a diminution in the pressure. A suggestion was made, that the companies should be applied to, to reduce the price paid for the public lamps, as the board were paying prices varying from £5. 5s. to £6. 12s. per lamp per annum, while Lambeth parish paid only £4. 10s.

The CHAIRMAN remarked that what the board required was a definite statement of the average quantity of gas consumed per hour, and then they would be able to make calculations to ascertain how much they were overcharged.

Mr. WALTON said, that he had received some information from a friend which stated that a public lamp consumed about 20,000 cubic feet per year, or 5 feet per hour, and that the charge made by the company with which he was connected (five guineas per lamp per annum) was calculated upon the basis of the gas being 4s. 6d. per 1000 feet, 10s. for lighting and cleansing, and 5s. for repairing. Mr. Walton said that he was not satisfied that their district ought to be charged five guineas per lamp. He suggested that a committee should be appointed to inquire the price paid by other public boards.

Mr. TOLCHER had been for some time satisfied that their district were paying too high a price for the gas supplied to the public lamps. Lambeth made certain representations to the companies, by which the price was reduced, and it would be a disgrace to the Wandsworth district if they did not do the same. He had been expecting that statements would have been made to the board upon which they could ground an application to the companies, showing that they were considerably overcharged.

ST. MARY, NEWINGTON, VESTRY, WEDNESDAY, OCT. 1.

A letter was read from the Phœnix Gas Company in reference to the want of illuminating power in the gas supplied by them on the 19th and 20th ultimo, regretting that there was any cause of complaint, and stating it had arisen from an additional retort being required on account of the long evenings. There had been some neglect on the part of one of their officers, and the superintendent of the Vauxhall station had been reprimanded. They trusted there would not be any recurrence of this cause of complaint, and pointed out that, as a rule, the illuminating power of the gas was above the parliamentary standard.

TAX ON GAS IN AMERICA.—The *Scientific American* says that a resolution has been adopted in the Board of Councilmen, directing the counsel of the Corporation of New York to prepare the necessary papers to transfer all the rights and privileges of the New York and Manhattan Gaslight Companies of that city, in consequence of their expressed determination to make an extra charge of fifteen cents for every 1000 feet of gas consumed by their customers after the 1st of last month.

STEAM-BOATS LIGHTED WITH GAS.—The Wallasey commissioners, who have taken the lead in introducing the most perfect construction of ferry-boats that ever floated on the waters of the Mersey, seem determined to maintain their supremacy by availing themselves of every improvement. Their splendid new boat, the Water Lily, is now lighted by gas throughout. Instead of the dull, lurid flame produced by oil, the signal-lamps are brilliantly illuminated by a jet of the clearest gaslight. It does not require more than fifteen minutes to charge the receiver with sufficient gas for a night's supply. The apparatus is constructed to prevent all possibility of an explosion, and is not in any way affected by the motion of the boats. The cost of illumination will be at least 50 per cent. less than that of oil. The light only requires to be seen in order that its superiority may be appreciated; and, as in a small vessel the receiver is capable of containing a supply for three nights consumption, we may expect in a short time to have our steamers as they cross the Atlantic brilliantly lighted with gas.—*Liverpool Mercury.*

THE PROPOSED TAX ON GAS IN NEW YORK.

[From the *American Gaslight Journal.*]

In our last issue, we noted, in a gentle way, the fact that some of the gaslight companies had determined to avail themselves of the clause in the excise law, empowering them to charge to consumers the tax upon their product, which, by every principle of right and justice, the companies themselves should pay.

It was our impression then that a sober second thought would lead those companies—the New York gas companies in particular—to review this decision, and submit to the very reasonable assessment upon their profits; but it is not so: there is no sign of such intent; nor do we believe any exists in that quarter.

It is useless to mince words about this act of the gas companies—we mean those who have availed themselves of this permission; and we refer particularly to the New York, and the Manhattan, and the Brooklyn, New York; that is the coolest piece of imposition ever attempted by a corporation upon an intelligent people. This accounts for the presence of officers of several gas companies in Washington last winter, dining and perhaps feeing members of Congress; bamboozling them with wine and money to commit a glaring wrong upon the people.

Here are twenty men in New York who own the majority of the stocks in the Manhattan and New York gas companies; men, rolling, wallowing in wealth, who conspire in their secret caucus to punish the people because *they* (these men) are so rich. To a country gas company, whose product is small, the tax is 5 cents per 1000 cubic feet; while, to the city companies, whose product is immense, the tax is 15 cents. per 1000 cubic feet, so that the city residents are absolutely punished for the exorbitant profits the city companies are rolling up.

We say that the minds that conceived, the tongues that advocated, and the hands that perpetrated this outrage upon the people, are a disgrace to their possessors. Here are corporations making over 100 per cent. per annum profit, dividing annually from 20 to 30 per cent., and investing the remainder in additional works, unwilling to bear the least share of the nation's burden.

Here are men, professing to be good citizens, playing the Pharisee to their least wealthy neighbours, committing a mighty outrage upon Congress, and an untold wrong upon their fellow-citizens. The fact is, the day has arrived to put a stop to these mammoth monopolies. The common council of this city has already determined to try the right of the city to assume the charters of these companies, and we hope they will do it. The gas which we now burn can be made, *is made*, for less than $1. 15. per 1000 cubic feet, *first cost;* from that deduct the sales of coke and tar, and the cost of the gas is reduced to a good deal less than $1. *Will the New York city gas companies dare deny this?*

New York is large enough for half a dozen gas companies. Let us have them. The Metropolitan (opposition) is going on rapidly to completion, and there is room for two or three more.

The stock of the Manhattan Company is selling at 70 per cent. above par; that of the Old New York, at 120 per cent. above par. The Brooklyn concern has got a spicy little opponent in the Citizens, which will take care of the spare premium on the stock of that company. This journal is the organ of the gaslight interest in its broad, public-spirited, fair-dealing sense; but, it is no friend to, and no organ of, selfish, sordid men, who refuse to assume their fair proportion of a public burden, who have the unblushing impudence to foist upon Congress a provision to enable them to sneak out of that responsibility, and secure them in their monstrous gains by robbing the poor and working classes. But they will soon have their deserts. The Harlem, N.Y.; Citizens, Brooklyn, N.Y.; New Bedford, Massachusetts, and Philadelphia (city works) pay their own tax.

THE DUBLIN WATER SUPPLY.

REPORT OF THE WATER-WORKS COMMITTEE.

At a Special Meeting of the Council of the City of Dublin, held at the Guildhall, on Wednesday the 17th ultimo—the LORD MAYOR in the chair—

The TOWN-CLERK brought before the council the following report from the Water-works Committee, which it was unanimously agreed should be taken as read, and distributed amongst the members:—

Your committee have to report that, in the discharge of the duties imposed on them by the Act of Parliament, and by your appointment under that Act, they proceeded to get detailed working drawings and specifications prepared for all your works. Anxious that the council and the public should know, before commencing the works, the actual limit of expenditure that would be required to bring the Vartry waters into Dublin, they resolved not to enter into contracts either for pipes or for the making of any portion of the works till they would be in a position to solicit tenders for all, and thus be able to inform you, with the confidence given by actual contracts, the result of the most open competition, what the absolute extent of the cost of constructing your works would be.

They felt that in deferring the pipe contract, they ran some risk of an advance of price in a material constituting a large item in the total expenditure; but, by pressing on the completion of your plans and specifications, and watching the iron market and the varying propects of the sad conflict in America, which was certain so largely to influence that market, they could hardly fail to accomplish both objects—viz. get a pipe contract before any serious advance would take place, and be able to give you a definite and fixed limit to your expenditure for all your works. After all the controversy that took place with respect to the probable cost of construction—some gentlemen of commanding influence in the city fixing the cost at *one million sterling*, others at sums ranging from that down to £500,000, and none, absolutely none, save the few who had faith in the ability of your engineers, and in the prudence of your committee, believing that the construction of the works would cost less than from £350,000 to £400,000, your committee felt that it was of paramount importance to be able to show the end as well as the beginning of the cost of construction before entering into any contract for any portion of the works. The remarkable example of Liverpool, in which the cost of construction was double the estimated expenditure, which was so often cited in the debates in the council, and outside as a reason why no such project as the Vartry supply should be prosecuted at all, was continually before the mind of your committee. In Manchester, the constructive cost exceeded the estimate by half a million. In Glasgow, a similarly ominous warning, in the shape of an excess of more than half a million beyond the estimates, not unnaturally alarmed the citizens of Dublin, lest an equally ruinous expenditure should be rashly entered on by the more sanguine advocates of an improved water supply. It is, perhaps, well that these examples were so repeatedly urged against the proposal to get a pure and abundant water supply. It is, perhaps, well that these examples were so repeatedly urged against the proposal to get a pure and abundant water supply for Dublin, and your committee are free to confess that they have profited to no small extent by the very alarms and oppositions that were excited by the constant repetition of these striking examples of constructive cost, exceeding by nearly cent. per cent. the estimated expenditure. The fact that in these three large cities—admitted to be the best supplied cities in the empire—the expense of bringing within the municipal bounds the impounded streams of mountain districts so largely exceeded the anticipated cost, caused your committee, even at the risk already alluded to, not to take a single step in the constructive portion of their duties till they could bring before you a full statement of the extreme limit of the cost, in order that no ground should exist hereafter for charging your committee with having rashly committed the ratepayers to an unknown expenditure by commencing the works, not, perhaps, without counting the cost, but without ascertaining and demonstrating the extreme limit of expenditure.

Your committee, therefore, determined to revise the whole project in all its parts to the very minutest detail, in order to be able to point out to you every possible alteration, improvement, and addition to your works which might involve increased costliness, before entering into any contract or commencing any work. They felt it was due to you, due to the citizens, and due to their own reputations, to avoid the errors committed in other cities, and to take a course that would prevent the necessity of increasing your works and your expenditure when your works would be half completed. The result of this revision they will now place before you in detail.

Resolved to secure the greatest amount of perfection and permanence in your works, which care, experience, and skill could suggest, your committee requested your engineers to review the whole and every part of the plans. Their instructions were, not to be content with the ordinary modifications and improvements consequent on making detailed working drawings of the outline plans deposited in Parliament, and which are provided for by the 10 per cent. allowed on all parliamentary estimates for contingencies, but to ascertain whether any, and what alterations might be made to render your water supply more abundant and unfailing, and your works more secure and efficient for their intended purposes.

After a most careful application to the subject, your engineers advised that, though your works were admirably planned and most skilfully contrived, there were some alterations which would enhance their efficiency, and secure protection against all future chances of failure or disappointment, resulting from accidents which no human foresight could guard against, and which alterations it would, in their opinion, be most imprudent to omit. The importance of such security was so obvious, that your committee caused the alterations to be embodied in your detailed drawings and specifications.

The principal of these changes, may be stated in untechnical phraseology, in such a manner as to render the intention and value of the improvements intelligible to all who will take the trouble of examining the subject.

The Additional Works

may be conveniently taken in the order of the line of works, commencing at the great storeage-reservoir at Round-wood.

No. 1.—In the great embankment at the Roundwood reservoir forming the basis of your whole project, several additions to quantities, and some modifications in the form of the bye-wash, were suggested to give greater strength to the embankment, and a more free outlet to casual mountain floods, and thus more effectually to guard against accidents. Other alterations in the arrangement for drawing off the water for use, and in the construction of the tunnel, the valves, and valve-house, were made with the same intention. It was estimated by your engineers that these new works thus added to your parliamentary plans would cost about £7000. The object being to give greater stability and more certain security against accident, your committee gave to these proposed additional works their entire and cordial sanction.

No. 2.—The main-pipe from the end of the tunnel near Newtown-Mount Kennedy was laid down on the parliamentary plans as of 32 inches internal diameter. A pipe of this size, with the amount of fall given by the natural gradients of the pipe-track, was calculated to be capable of conveying over 13 million gallons daily to the Stillorgan reservoir. The tests of the actual rain-fall in the Vartry district established by Mr. Neville, your city engineer, have satisfied him that your reservoir will be capable of yielding a much greater quantity, and it was, therefore, thought advisable to increase the diameter of the main-pipe by *one* inch, which in practice, instead of an increase of 1-32nd, will give nearly 1-7th more water, or 15 million, instead of 13 million, gallons daily. If, at any time hereafter, the demand for water for commercial purposes should increase, which is a reasonable expectation, when it is remembered that the water sold for commercial and manufacturing purposes in Liverpool and Manchester respectively produces a larger sum than the rates, this additional quantity of water will be most valuable. Your committee, therefore, resolved upon at once sanctioning this additional work, by which you will get as much as 2 million gallons of water daily for an additional expenditure of about £8000, an increased supply which you could not procure hereafter for less than £40,000 or £50,000.

No. 3.—Your storeage-reservoir at Stillorgan was designed to contain three and a half days supply, and your parliamentary plans and estimates were based on the amount of works that would be required to provide that storeage. Your committee are of opinion, and in this they are fortified by the joint opinions of your city engineer and your consulting engineer, that it would not be prudent to provide for less than ten days supply in your storeage-reservoir, which is supplied from your great impounding reservoir by a single pipe; inasmuch as if by any accident that pipe chanced to be injured, or if any other unforeseen event necessitated the execution of repairs along the main line, the city would be in danger of having a short supply. Your engineers have, therefore, provided for an increased storeage in your Stillorgan service-reservoir, amounting to about ten days supply, which, it is considered, will be amply sufficient to protect the city against such a contingency as has been referred to. The cost of this additional work will be about £5000.

No. 4.—The parliamentary plans provided for a single large pipe for conveying the supply from the service-reservoir at Stillorgan for distribution in the city. It is obvious that, were any accident to happen to any portion of that single pipe, or to any of its valves, the city could have no water supply during the time occupied in making the necessary repairs. Your committee, therefore, decided that instead of one large pipe there should be provided two pipes of smaller, but still of large, dimensions, to convey the water to the city. This alteration of plan will effectually guard against the possibility of the calamity adverted to. The cost of the additional works, including the pipe, will amount to about £6000.

The total of these four additional works were estimated by your city and consulting engineers, in round numbers, at about £26,000 or £27,285, including some improved valves and contingencies. The materials of these estimates are so few and so simple that there is hardly any room for error. You may, therefore, confidently assume this sum to be the true value and probable cost of the several new works which have been superadded to your works, as contemplated by the parliamentary plans and estimates.

You will remember that the parliamentary estimate for your works, as based on the outline plans deposited in Parliament, was £216,335. 1s. 7d., *plus* £21,633. 10s. 2d., being the 10 per cent. for contingencies, which is the usual sum allowed as the probable additional cost consequent on converting parliamentary plans into detailed working drawings, accompanied with minute specifications as to the materials, quantities, and form of construction. If to the parliamentary estimate you add the cost of the additional works deemed essential to greater stability, efficiency, and security, you will obtain these results:—

Parliamentary estimate	£237,968 11 9
New works, as above detailed . .	27,285 19 0
Total estimate	£265,254 10 9

Your committee deemed it advisable to make a conditional arrangement to enable you at any time hereafter to construct filter-beds upon the most approved principles. They, therefore, took the requisite quantity of land immediately adjoining the site of your great reservoir at Roundwood; and, in contract No. 4, they asked for a separate tender for the filter-beds in accordance with plans and specifications, but with the special condition that it was to be determined at the discretion of the council whether they were to be constructed or not. Your committee advise that it will not be necessary to construct them at present, and they strongly incline to the conviction that no eventuality is likely to arise for many years to render their construction requisite. The cost of them would probably amount to from about £20,000 to £21,000. This sum is, therefore, to be deducted from the tender accepted by your committee. It will, of course, also be in the discretion of the council to determine whether or not the additional works specially enumerated, as No. 1, No. 2, No. 3, and No. 4, and so strongly recommended by your engineers as essential to the greater efficiency of your supply, shall be constructed. Your committee strongly urge on you the construction of these additional works, confident that they will meet the approval of the citizens at large, and that the increased efficiency, and, above all, the permanence and security of your works and of your supply, require their construction. The execution of these additional works will, in the opinion of your committee and of your engineers, render your water supply the most perfect and the most secure of any of a similar character in the United Kingdom.

When your specifications and working drawings were prepared, your committee, anxious that there should be the most open competition for your works, ordered that advertisements soliciting tenders be inserted once every week for six weeks in each of the following journals, viz., the *Times*, *London Builder*, *Engineer* (London), *North British Mail* (Scotland), *Freeman*, *Daily Express*, *Morning News*, *Irish Times*, *Saunders's News Letter*, *Evening Post*, *Evening Mail*, *General Advertiser*, and *Dublin Builder*. They also deposited plans and specifications in London, at the office of your consulting engineer, Sir J. Macneil, for the convenience of intending English contractors, announcing in the advertisements that they were so deposited, and that the plans might be examined and copied every day up to the 9th inst. This extensive advertising involved some additional expense, but it secured the great advantage of full competition. The result amply justified the expectation of your committee, for no less than thirty-one contractors tendered for one or more of the five contracts into which the works were separated. A list of the several competing contractors, and of the sums at which they tendered for the several works, are subjoined as an appendix. Some eminent houses tendered for two or more, some for three, some for only one of the five, while only one—Mr. M'Cormick, M.P.—tendered for *the entire five*.

In order that they might be in possession of a reliable standard, whereby to test the several tenders, and ascertain whether they represented the true value of the works to be constructed, and thus guard your committee against accepting too high a tender on the one hand, and against the more dangerous error of accepting a tender at which the works could not be executed, and the acceptance of which would inevitably lead to vexatious delays and litigation, and eventually to great pecuniary loss—as in the case of Liverpool, and other towns—your committee requested your engineers to attend, and place before them independent estimates, one prepared by each, of the true value and probable cost of the works.

The engineers submitted their estimates, which were prepared without concert, with the intention of comparing them after placing them before the committee. The estimate of Sir John Macneil was £278,154. 3s. 3d., including the filter-beds.

The estimate of Mr. Neville was £276,048. 2s. 6d., also including the filter-beds.

The closeness of these independent estimates shows, in the most conclusive manner, that the true value of the works was substantially ascertained by each.

The committee, having these data before them, proceeded to open the tenders; and, after a careful examination of them, and obtaining the personal advice of your engineers, in addition to the advice contained in the reliable test of the value of the works given in their independent estimates, they resolved to accept the tender of Mr. M'Cormick, who offered to execute all the works—to include all "*necessary extras*," which often form a very important item in settling a contractor's account—and to maintain your works in perfect repair for two years after their completion, for £274,000, which is £2000 under the estimate of your city engineer, and £4600 under that of your consulting engineer.

If you deduct from the tender of Mr. M'Cormick—which your committee accepted—the cost of constructing the filter-beds, say £20,000 or £21,000, which the form of the tender allows you to deduct, you arrive at £254,000 or £255,000 as the tender for the construction of all your works, including that most dangerous of all items, "necessary extras," and that most important element of security to your council and the public, a guarantee of maintenance, in perfect order, for two years. This tender absolutely limits the constructive cost of your works, as all extras which will be necessary to complete your present plans and specifications are included in it. Your committee look upon this tender as a most favourable one. By its acceptance, you will be saved all future trouble as to construction, and all uncertainty as to cost. One contractor of great experience and ample capital will be responsible for all your works. There can be no clashing between contractors, as would be the case if your committee were compelled, by the absence of a tender for the whole, to divide your works into sections, as seemed to be almost inevitable from the extent of the undertaking. The total sum which, by including extras, fixes the limit of cost, being £254,000 or £255,000, exceeds the parliamentary estimate by the comparatively small sum of £17,031. 9s. 3d., but it includes the cost of the second line of pipes from Stillorgan to Dublin—of the trebling of your water-storeage in your service-reservoir—of the providing the means of bringing an increased supply of 2 million gallons a day into the city—of greater permanence and security in your main embankment—of improved valves—and of other additional works not contemplated in your parliamentary plans, and which your own engineers value and estimate at £27,285, estimating the cost of the material and labour, but which are of inestimable value as the means of perfecting your system, and securing the citizens against all accident and risk.

There were some tenders sent in for some of the works which would represent a smaller cost if you were to take the lowest tenders offered for each of the five contracts; but your committee, fearing that it would be impossible to construct the works tendered for at the prices named, felt that either some gross error was made by the parties sending in these tenders, or that they were incompetent to value the works to be executed; and they, therefore, declined to accept them. In adopting this course, they had the entire sanction of your engineers, who distinctly stated that they would not be responsible for the safety of the works, if let at prices at which it would be impossible to execute them. They were mindful, too, of the calamities that befel the corporation of Liverpool, and of the Chancery suits, delays, and vexations that followed—not the least of which was the large addition to the cost of constructing the works. There were, however, so many advantages offered by the comprehensive tender and the favourable conditions of Mr. M'Cormick's offer, apart from its being so much under the estimates of your engineers, and yet being so near an approximation to them as to show that the tender was based on a just and fair valuation of the works, that they did not hesitate to accept it. The advantages offered by the special terms imported into this tender—which we append—give great confidence to your committee, and will give equal assurance to the public that the work will be well done; and that even those who were up to the present alarmed at the possible contingent cost of so large an undertaking, and at the examples of Liverpool, Glasgow, Manchester, &c., will be agreeably surprised to find that the total constructive cost of your magnificent project will exceed your parliamentary estimate by so small a sum, while it is in reality £10,000 under the detailed estimate of your own engineers. Your committee, in asking your approval of this tender, and of their acceptance of it, cannot but congratulate you, and, through you, the city at large, at having the constructive cost of your works thus absolutely defined, ascertained, and fixed at a sum within that which the most sanguine could have hoped to obtain the perfection provided for by your present working drawings, and so enormously under the cost which all classes of the citizens would have willingly accepted as a guaranteed maximum at any period since the project was first decided on.

(Signed) JOHN GRAY, Chairman.

APPENDIX No. I.

COPY OF TENDER OF WM. M'CORMICK, M.P.

To the Water-Works Committee of the Corporation of Dublin.

Gentlemen,—Having examined the plans and specifications of contracts Nos. 1, 2, 3, 4, and 5, of the Dublin Corporation Water-Works, I hereby agree to execute the same, together with all necessary extras, for a total sum of two hundred and seventy-four thousand pounds sterling.

I will take part payment in corporation bonds, bearing interest at a rate to be hereafter agreed on, and to an amount to be determined at the signing of the contract. Ten per cent. only to be retained out of each certificate, one-half of which per centages is to be paid to me on the admission of the water to the pipes, and the remainder at the end of the twelve months maintenance, or two years as agreed.

The usual arbitration clause to be inserted in the contract-deed.

I will not be responsible for any permanent loss of water which any parties may sustain in consequence of the proper execution of these works.—I am, Gentlemen, your obedient servant,

WM. M'CORMICK.

41, *Parliament Street*, *Westminster*, *London*, *S.W.*, *Sept.* 9, 1862.

P.S.—From my long experience in carrying out water-works of various kinds, I am aware what expense always arises from dividing the work into many contracts. I have, therefore, only offered for the whole, but will agree to keep all the works named in this tender, for two years in perfect repair.

My estimate for the portion of your works which were included in the original design, which I supported in Parliament, is about £214,000. The extra works, such as filter-beds, the double service-pipe from Stillorgan, the increased diameter of the main-pipe, increased size of the Stillorgan reservoir, amount to about £48,000. The charges consequent on the making out detailed drawings was estimated by Mr. Hawksley at 10 per cent., but I find that my tender reduces it below 5 per cent.

Should the corporation have a difficulty in finding funds to cover these extras, I would willingly enter into some arrangement by which they may be made a matter of current account between me and the corporation.

Mr. H. Greene will attend as my agent in my unavoidable absence.

APPENDIX No. II.—*List of Parties submitting Tenders for Contracts for Works in Connexion with improved Water Supply.*

No.	Name.	Address.	Contract No. 1, for Pipes.	Contract No. 2, for Cocks, Valves, &c.	Contract No. 3, for Laying Pipes, Storeage, &c.	Contract No. 4, for Storeage, Reservoir, Filter Beds, Tunnel, &c.	Contract No. 5, for Stillorgan Reservoir.
			£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
1	Henry Grissell	London	. .	3226 2 0	. .	. .	. .
2	William Simpson	London	. .	2207 7 4	. .	. .	. .
3	William Baker	Bristol	. .	. .	45,948 1 1	. .	. .
4	George Jennings	Oxford	. .	2745 15 0	. .	. .	. .
5	James Aitkin	Glasgow	. .	2101 15 0	. .	. .	. .
6	Thos. Dunne and Co.	Manchester	. .	2627 15 6	. .	. .	. .
7	Richard Neville	Llanelly	. .	1794 8 8	. .	. .	. .
8	Hennet, Spinks, and Else	Bridgwater	. .	2418 5 4	. .	. .	. .
9	Cochrane and Co.	Middlesboro'	102,425 9 7	. .	. .	. .	. .
10	Ormond, Grierson, and Co.	Manchester	. .	2869 0 0 2609 0 0	. .	. .	. .
11	Edward Toomey	Dublin	. .	2341 14 0	. .	. .	. .
12	Henry Birley	Wigan	108,143 16 3	. .	. .	. .	. .
13	Thos. Spittle	Newport	£6.5s. p. ton, or 125,000 0 0	. .	. .	. .	. .
14	Thos. Doewra	London	. .	. .	44,775 12 1½	. .	. .
15	William Handwick	Stafford	. .	2684 19 6	. .	. .	. .
16	Peters and Co.	London	. .	. .	56,000 0 0	. .	. .
17	D. Y. Stewart and Co.	Glasgow	101,418 16 0	. .	. .	. .	. .
18	A. H. Smith and Co.	Glasgow	. .	3012 12 0	. .	. .	. .
19	Moore, Brothers	Dublin	. .	. .	. .	110,626 1 3	. .
20	WM. M'CORMICK, London and Derry, Tenders for all, £274,000						
21	Guest and Chrimes	Rotherham	. .	2160 17 0	. .	. .	. .
22	David Manwell	Glasgow	. .	. .	42,790 19 10	. .	. .
23	Edington and Sons	Glasgow	99,926 16 9	1809 15 0	46,525 8 11	. .	. .
24	William Barker	Liverpool	. .	. .	34,335 10 3½	. .	. .
25	John Martin	Dublin	. .	. .	. .	. .	29,183 2 0
26	Moxon and Co.	Dover	. .	. .	34,170 8 5	69,019 16 5	23,737 14 7
27	W. G. Armstrong and Co.	Newcastle-on-Tyne	. .	3965 10 0	. .	. .	. .
28	M. H. Bourke	Dublin	. .	. .	. .	. .	19,513 5 8
29	J. Enright	Dublin	. .	. .	. .	. .	18,000 0 0
30	Edwards, Brothers	Belfast	. .	. .	51,377 15 1	151,075 5 11	23,000 0 0
31	J. Byrne	Dublin	. .	. .	. .	. .	20,793 12 8
			Average of 5, 107,382 19 8	Average of 15, 2571 13 1	Average of 8, 44,490 9 5	Average of 3, 110,240 7 10	Average of 6, 22,371 5 9

Average total, £287,056. 15s. 9d.

COUNCIL MEETING, WEDNESDAY, OCT. 1.

A Special Meeting of the Council was held to-day, at the City Hall—the LORD MAYOR in the chair. The following members also attended:—Aldermen Campbell, J.P., Mackey, J.P., Carroll, Roe, D.L., and Reynolds. Councillors Bonsall, Warren, Whelan, Scally, J.P.; Draper, Martin, Wharton. Tarpey, Redmond, Gray, J.P.; Plunket, Casson, J.P., Graham, Acheson, O'Brien, J.P., Gavacan, Treston, Dunne, J.P.; M'Cann, O'Beirne, O'Neill, Butler, Ryan, Lawless, Chambers, Rochford, French, Egan, Kelch, Lalor, J.P., and Vereker, Hon.

Dr. GRAY said: I have to move that the report of the Water-Works Committee be confirmed by the council. The report enters so fully into the whole question, and gives so clearly the reasons for the several courses adopted, that it is hardly necessary for me as chairman to do more than draw your attention to one or two points. You have seen that the report recommends three or four distinct additions to the works which were suggested by the engineers; and the report gives a plain statement of the causes which induced the committee to adopt these suggestions. I will take them *seriatim*, for the purpose of making them perfectly clear. The first is an alteration in the reservoir at Roundwood. This is recommended for the purpose of making security doubly secure, and preventing the possibility of any accident ever occurring so far as human provision can guard against all accidents. One of the principal arrangements we have made is a deviation from the principle usually acted upon in other water-works, and the evil of which has been found by experience. In many systems of water-works, where impounding reservoirs have been constructed, and provision has been made for impounding a large quantity of water, moveable sluices have been used in the bye-wash to let off the heavy flood-water, and this is done by the person in charge of the sluices opening them as occasion requires. This was the principle of the original plans for our reservoir; but, after some time, we came to the conclusion, upon the suggestion of our engineers, that it would be far wiser to have our "bye-wash" made in such a way that no care or attention would be requisite for its action, but that from its construction and the nature of the opening, the required protection would be obtained without the intervention of the person in charge. I put the case thus. Suppose a flood came down suddenly, as often occurs in a mountain district—suppose the man in charge was absent when he ought to be present, the sluices not being opened when the flood came, damage would be done to the country, and serious damage done to our works. After neglecting his duty, and after the damage was done, the first thing the man in charge would probably do on his return would be to throw the sluices on the bank, and say he removed them in time, but that notwithstanding the damage was done. Now, under the principal change to be made in the construction of the bye-wash, no care of this kind will be required—no flood can come down that it will not take off, and no accident such as I have referred to can occur. Another change is increasing the quantity of puddling to prevent leakage. It will give additional strength to the embankment. There is also some additional expense arising from double pipes and valves, so that if one valve should not act the other valve would give a supply. The cost of all these makes up a considerable sum, but very small as compared with the advantages gained; and, I think, every one who values the importance of having our works secure, not only for the present, but hereafter, will sanction the course taken by the committee. The second change is an increase in the diameter of the main-pipe. A good deal of discussion arose from time to time with regard to the amount of rain-fall. From the moment the royal commission recommended the Vartry, means were adopted for regularly ascertaining not only the rain-fall in the district, but also the quantity of water actually passing in the river. We find that the rain-fall is larger than the engineer expected, and that the quantity of water passing through the river is also larger than was calculated upon. Under these circumstances, we thought it well to incur a small increase of expense to enlarge the main-pipe, so as to bring down every day 2 million gallons more, or a total of 15 million gallons daily. The total amount of that increase is about £7000; whereas, if we wanted hereafter to increase the size of the pipe and secure an increased supply for manufacturing purposes, or for fire, the expense that would have to be incurred would be very considerable. The third change is an increase of the capacity of the service-reservoir at Stillorgan. If any accident happened to the pipe conveying the water down from the storeage-reservoir, where we will have 260 days supply, we would have to depend on the Stillorgan reservoir. That was designed to contain a supply for three days and a half; but we thought that an addition of £5000 or £6000 in a sum of from £20,000 to £24,000 would be small, when we considered the great advantage to be gained of having an ample supply in the service-reservoir, to meet the contingency of an accident to the pipe from the storeage-reservoir. For this increase of expense, we can enlarge the containing capacity of this reservoir from a three and a half days to a ten days supply. I do not like to say that it will be beyond ten days, but I think the supply there will be sufficient for eleven or twelve days, which will guard against the possibility of being run out of water. The next alteration is the laying down a double pipe from Stillorgan to Dublin instead of a single pipe. Stillorgan is the point from which the supply for the city will be immediately derived. A single pipe might be sufficient for the supply, but suppose any accident happened to the valves, we would be altogether without a supply of water, except what lay in the pipes. We, therefore, determined that, instead of having a single service-pipe running down from the service-reservoir, we would have two pipes of a smaller size, which would not add much to the expense, but would add enormously to the security against a want of water. The whole expense of these additions, you will find by the report, amounts, including contingencies, to £27,000. But as we will be able to get a contract for all the works from a man of capacity and ability to do our works for £10,000, under the original parliamentary estimate, the real addition to the whole cost is practically £17,000. If your committee had not taken the precaution, which all the members of the committee approved, of suggesting that it would be prudent for us to come down and say to the House, we find our parliamentary plans are not sufficient, we could get our work done under the parliamentary estimate. No doubt our plans were perfect as far as they went—but, in order to make our works the most perfect of any water-works hitherto constructed, so as that, foreseeing the evils that may arise, we may guard against those evils, we advise these additional works. If this was not done now, but was postponed until after the works were completed upon the parliamentary plans, the great probability is that the vast advantages we are now securing for an addition of £17,000, would cost £50,000 or £60,000 more. In taking this course, we show our deference to the wishes and feelings of the council, and of the citizens; and the engineers and the committee show their anxiety to do what is for the benefit of the city. You will remember, my lord, that there was a good deal of controversy at the time of the passing of the Act, as to whether we would be able to get our works done at the amount estimated by our engineers. We now have a contract accepted provisionally by the committee, subject to the approval of this House, for doing all the works contemplated in the parliamentary plans at £10,000 less than the sum we then estimated for. Very strong evidence was given, and very strong statements were made before the committee of the House of Commons, that we never would be able to construct our works for the sum stated. Our estimates were compared with those for the Liverpool, Glasgow, and Manchester Water-Works, for the purpose of showing the citizens of Dublin that our works would cost considerably more than we stated. I am happy to say that we are in a position to show you, not by the assertions of engineers, or the assertions of energetic advocates of any water scheme, but by actual tenders and by contracts entered into subject to your approval, that the works included in the parliamentary plans will be done for £10,000 less than the parliamentary estimate, or for £17,000 more, including the additional works which, as matters of security to the city and character to the corporation, are worth double the sum. In this all necessary extras are also included. Any of you who have ever engaged in any building works know that extras form a very large item in the account at the close. Where we have our contract covering all necessary extras, there will be no addition to the cost upon you. The sum you will have to pay for all is defined. Every plan has been redrawn, every mea-

surement has been remade, and every calculation rechecked again and again by competent engineers, and you have as the result the contract for all the works to be done within the original estimate. You are all aware that we have had several tenders, and that one of them represents a much smaller sum for some of the works than the amount of the contract provisionally accepted, if the same portion of the works, with their cost, were taken separately. I allude to the tender of Mr. Moxon. The course taken by the committee with reference to the tenders has been so fully stated in the report that I need only remind you that we gave the greatest publicity to our intentions with respect to the tenders. We did not receive them till late on the day before that appointed for opening them. Next day, when we came to open them, having asked our two engineers to make out independent estimates, Sir John Macneil made his independently of the estimate made by Mr. Neville, and both were placed before us. The parliamentary estimate was made upon the parliamentary plans. There is always an allowance for the alterations made in improving details, and defining the form of the works and the class of materials to be used. The estimate which Sir John Macneil produced to us on the morning we proposed to open the tenders was made upon the improved plans and alterations. He and Mr. Neville arranged, for the purpose of checking each other, that they would not compare a single item till they compared the sum total, and then compared the items. When the tenders were about to be opened, Sir John Macneil and Mr. Neville produced their estimates, and there was a difference of about £2000 between them. This gave us a considerable guarantee that both had arrived at a practically accurate result. When we found that they nearly corresponded with the original parliamentary estimate, we had abundant guarantee for accuracy, for that original estimate was subjected to the careful scrutiny of Mr. Neville, Mr. Hawksley and his assistant, Mr. Hawkshaw, the Royal Commissioner, and his assistant, and of the parliamentary committees. So we had five engineers concurring more satisfactorily to our judgment than if they concurred to a figure. They concurred substantially, which showed us they knew practically the value of the works they were estimating. Before we opened any of the tenders, we looked at these estimates and saw the figures. We were then in a position to form our judgment upon the tenders. The tender of Mr. M'Cormick included a quantity of work for filter-beds, with which we do not deal at present, but we have made provision for them, should they be found desirable. The reason we did make this provision was that we apprehended some fouling of the water from the washing in of road-stuff, but we have determined, by the advice of our engineers, not to proceed with these works for the present. But the tender of Mr. M'Cormick, covering the whole of the works, including all necessary extras, and giving us the guarantee of keeping your works in perfect repair for two years, thus showing the *bonâ fides* of the work he gives us, that tender was considerably over the tender of Mr. Moxon, but under the estimate of all our engineers, under the estimate of Sir John Macneil, under the estimate of Mr. Neville, under the estimate of Mr. Hawkshaw, the Royal Commissioner, under the estimate of Mr. Hawksley, under the parliamentary estimate as canvassed before the committee of the House of Commons by the agents of both the corporation and their opponents. You may say: "Why not accept the tender of Mr. Moxon, which was lower than the tender of Mr. M'Cormick?" We said, "What we want is honest work for an honest price; we don't want to accept tenders which men cannot possibly fulfil." Our engineers told us that the tender of Mr. Moxon must have been made upon some gross miscalculation, and that they would not be responsible for the security of the works if the committee accepted the tender, because the works could not by possibility be done for the sum mentioned in that tender. We had before us the example of Liverpool, where the corporation unfortunately accepted a tender against the advice of their engineers, and the result was that the expense accruing to the corporation from that course nearly doubled the original estimate for their works. The committee, impressed by the opinion of their engineers, said: "We want no bargain from any man—we want to put no man in the difficult position of having to expend more money upon the works than he would be getting from us; we do not want—no matter how good the guarantee of the parties offered as securities—to be driven to take their money, for which we could give them no value; all we want is full and fair value for our expenditure, and with that we will be content." Then we had this additional experience before us from Liverpool, that there, owing to the breaking down of the contractors from their prices, which were accepted by the corporation, not being equivalent to the fair value of the work to be done, in one case the works were stopped for more than a year; they were put into Chancery with the consequences of litigation, trouble, expense, and delay, and eventually, as I have stated, the works cost nearly double the amount of the estimate on which they were taken by the contractors. We therefore determined, when we got a tender from a solvent and competent man, who has spent nearly all his life in the construction of water-works—for they are the great *forte* of Mr. M'Cormick, who has done more, perhaps, in the way of shutting out water and keeping in water than any other contractor in the empire—when we got that tender, offering to do our works within the sum which our own engineers told us was the fair value of the works—offering, too, at the tendered price to guarantee us against all further trouble, saving us hereafter from the controversies that might arise between contractors, by one seeking to remove the blame from his own shoulders to the shoulders of another—saving us from one contractor saying of another: "I was ready to go on with my work, but he was not ready; I did my work well, but he did his work badly; I laid the pipe rightly, but he cast the pipe wrongly; I joined the pipe well, but he constructed the bed badly;' each man finding reason in the default and neglect of another for the error and defect of his own work. When, I say, we had a tender from a respectable and capable man—a tender within the estimate of our engineers, and saving us from the evils I have indicated—we thought that it was a highly beneficial course to accept that tender under which all your works will be constructed and perfected for the one sum; and you will then have no further trouble hereafter in respect to them. That course has been taken by the committee. When we got the tender of Mr. Moxon, we entered into an examination of its details, for the purpose of ascertaining the errors. Mr. Moxon made very serious miscalculations, which were plainly to be found on the face of his tender. This is, I think, a matter that the council should have fully explained to them; and, in order that the council may understand it, I will mention some of the details of one of our works. It is very hard, without diagrams and drawings, to make works thoroughly understood; but I will endeavour to explain the particular work in question in this way: We have at Roundwood a large reservoir, covering 500 or 600 acres. From that reservoir, we have a conduit-pipe leading to a very high hill, composed of the hardest rock. Through that mountain of rock we run a tunnel for conveying the water 2½ miles. In order to construct that tunnel at the depth at which it will run below the surface of the earth, we had to purchase land and make provision for sinking eighteen shafts from the upper surface down through the rock into the level in which the tunnel is to run. Those shafts thus to be run down through the solid rock vary in their depth from 190 feet to 40 or 50 feet; the tunnel itself will be 6 feet high, and 5 feet wide. With this explanation, you can form some estimate of the nature of the work to be performed in sinking those shafts through the solid rock to the level of the tunnel, which is to open 6 feet high and 5 feet wide, and be constructed of this size for 2½ miles. This was one of the works tendered for by Mr. Moxon. Not far from the hill I have mentioned there is a lesser hill, some of the water of which, by the natural fall of the country, runs not into the Vartry, but into another stream. We have taken powers to collect that water; and the mode of collecting it is, to make a large cut round the surface of the hill, near its base, into which the water is turned, which causes it to flow in a direction towards the Vartry, and thence is conveyed to our reservoir. The open cut to be made in carrying out this work is something like the large ditch or fence used in the country parts to cut off one field from another. It is set down in our specification that the contractor is to tender for making that open cut in the field at so much per lineal yard—that is, so much per yard for every yard in length. It is also stated in the specification that the contractor is to tender for the tunnel at so much per yard. Of course, in making that open cut in the field, we were anxious that no portion of it should be subject to intrusion, and, therefore, it was to be covered over with ordinary flat stones and soil, to protect it from cattle and intrusion of any kind. You have before you two classes of work for which the tender has to be made at so much per lineal yard. Remember, there was no allowance whatever in the lineal yard made for the shafts. Whoever undertakes to make the tunnel was to undertake it at so much per lineal yard, including the shafting and the opening of the rock to 6 feet by 5. Any man of sense must at once see the relative value of such work when compared with the cutting of the conduit in the field; and any man of sense would say that the value of the one work was nearly five times the amount of the other, as, in fact, it is. Yet, when we came to look at Mr. Moxon's estimate, we found that Mr. Moxon had put down—of course, by some miscalculation or mistake—I think, it must be a clerical one—26s. per lineal yard for the tunnel, and 48s. per lineal yard for the open cut running round the hill! Well, with these figures before us, could we hesitate for a moment as to the course we ought to take? It was physically impossible that the work in question could have been done by Mr. Moxon at the price in his estimate. The very powder for the blastings would have cost more; and let me tell you that in this item alone the difference between the true value of the work to be done and the sum erroneously put down by Mr. Moxon for the work amounted to something like £16,000. Well, there were a number of other items in which similar mistakes were made; and, under these circumstances, you will say that your committee and your engineers were right in thinking that they should not ask the council to enter into a contract for the construction of the works at a sum for which it was simply physically impossible that the works could be constructed; and that they were right in accepting a tender which was a tender at the fair and honest value of the work to be done—a tender that guaranteed us against all possible extras—a tender that secured the perfect completion of the works, and the handing up of the works at the end of two years after the commencement of the supply of water to our pipes, in the most perfect order, and in the highest state of efficiency. I feel that I have intruded at some greater length than I ought to have done upon the time of the house; but I felt the necessity and importance of making these explanations. I trust, the council will accept my apology for having trespassed upon their attention at such length; and I conclude, my lord, by moving the adoption of the report, and its confirmation by the council.

Mr. Bonsall said, he wished to know whether the party who put in the lower tender offered security, and, if so, why was not that tender accepted, as the council could come down upon the sureties in the event of the contractor having made a miscalculation?

Dr. Gray observed, that he was surprised to hear such a suggestion from a man of Mr. Bonsall's rigid principles. If a man went into the shop of a trader and asked for change for a ten-pound note, it was very easy to say, as Mr. Bonsall now suggested, that it was the business of the trader to see that he only gave ten pounds for the ten-pound note, and not twenty pounds, by mistake. But, should an honest man take advantage of the error of the trader, would he not be bound to return the ten pounds given to him by mistake? He (Dr. Gray) said, that that was the principle which would guide every honest man, and he hoped it would guide the corporation in all their dealings. There were palpable, patent miscalculations in the tender of Mr. Moxon. He had explained one of them; he could have explained half-a-dozen others, all showing that the tender was made at a price for which it was physically impossible the works could be constructed according to the specification. Were the corporation, with the knowledge before them of these miscalculations—with the assurance of their engineers that the works could not be done for the sum in the tender—were they—because a man might induce his friends to offer pecuniary security, that he would do what he plainly could not do—to put themselves in a position to extract from the pockets of those securities thousands upon thousands of pounds, for which no value could be given, and, perhaps, be the means of reducing the parties and their families to ruin and beggary? The corporation could not honestly do this, knowing, as they did, that they would be robbing these men.

Alderman Roe said, that, as deputy-chairman of the Water-Works Committee, he would take the liberty of seconding the resolution moved by Dr. Gray. He (Alderman Roe) had always been of opinion that if the citizens of Dublin, numbering over 300,000, could be supplied with pure, and abundant water at a cost of £300,000, it would be of inestimable value to them. He had been sometimes shaken in his opinion, as to the practicability of constructing the works at that sum, when he had heard some of the most sagacious and well-intentioned persons in the community declare that they could not be carried out unless at a greatly increased sum; and, when he considered that public works generally exceeded the original estimate to a very large extent, it was scarcely surprising that he, for one, should have sometimes doubted the ability of the corporation to carry out the arrangement made before the committee of the House of Commons. They had met there, however, for the purpose of ratifying a contract to carry out the works at a sum actually under the sum then estimated. Hereafter, he was certain that the citizens of Dublin would be sensible of the great benefit conferred on them in bringing an abundant supply of pure water to the city, for, without doubt, they ought not to be satisfied to take their water supply from open canals. There never had been a public work of such magnitude as those which were now about to be commenced, which did not give rise to a good deal of controversy; but it was gratifying to know that, at length, all angry discussion on the subject had passed away. He had been absent from Dublin and his municipal duties for some weeks; but he had learned with satisfaction that the committee had secured the services of one of the most respectable con-

tractors in Ireland for the purpose of carrying out the works. The answer given by Dr. Gray to the question, why it was their interest to pay that gentleman a larger sum than had been tendered for by another, was, in his (Alderman Roe's) judgment, conclusive. He considered that the committee had exercised a sound discretion in accepting Mr. M'Cormick's tender in preference to one which was lower, knowing, as he (Alderman Roe) did from experience, the absolute danger of accepting the lowest. It was only recently that the members of the Ballast Board, of whom he was one, had the courage to give Mr. Dargan £10,000 more for the construction of a great and necessary work at the North Wall than they could have it undertaken for by another contractor; and he (Alderman Roe) believed that, if they accepted the lower tender, the works, which had been long since finished in the most admirable manner, would still remain unexecuted. He found that their own engineer, Mr. Neville, and also Sir John Macneil, had estimated the cost of the proposed works; and it was satisfactory to find that their estimates so closely approximated to the sum actually tendered for by the contractor. Every member of that house had experience of the accuracy of Mr. Neville's estimates for all the works which he had carried out for them during the last twenty years. He (Alderman Roe) trusted that there would be no division amongst them on the present occasion. He thought that gentlemen on the other side were quite right in discussing the question so long as they had any doubt of the success of the works; but, now that they had got a contractor who would undertake to carry them out at a sum which could not be exceeded—no matter what they cost him—it was to be hoped that bygones would be bygones, and that all would combine to carry out such a great, such a gigantic work.

Mr. JOHN MARTIN said he heartily concurred in every observation which had fallen from the respected alderman, whom they were all glad to see once more in his place amongst them. They had now a common object in carrying out the work, which was a sanitary improvement much required in the city, and, if they succeeded in it, as he thought there was now the strongest reason to believe they would, the citizens, as Alderman Roe observed, would have much cause to be grateful. He (Mr. Martin) also joined in saying that everything had been done up to the present time that energy, talent, and zeal could do to bring matters to their satisfactory state. The voluminous report of the committee, which had been placed in the hands of the members of the house, and with regard to the matters of improvement which it was thought necessary to provide for, he should say that they seemed to be well founded, so far as he could form an opinion. He confessed, however, that he was at first, and before he heard Dr. Gray's explanation, somewhat surprised to find that Mr. M'Cormick was to receive £51,000 more than another contractor had tendered for——

Mr. REDMOND said, that Mr. Martin would find that the difference between Mr. M'Cormick's and Mr. Moxon's tenders was only £24,360, and not £51,000.

Mr. MARTIN said that Mr. Moxon was an eminent contractor, who had already carried out many successful works. He (Mr. Martin) would repeat, however, that, if the works were carried out within the parliamentary estimate, the citizens of Dublin would have every cause of congratulation. With regard to one item, that for the Stillorgan reservoir, he would remark that it had been tendered for by a gentleman named Enright for £18,000—a gentleman who had already carried out contracts for that house, as to whose accuracy and personal character he (Mr. Martin) could bear testimony. At £18,000, Mr. Enright calculated a margin of profit of about £2000, which would show that Mr. M'Cormick ought to carry out the whole work well for £254,000. Another matter about which there was some misapprehension was the extras. He undertook to do certain extras pointed out by the committee——

Dr. GRAY: No, no.

Mr. MARTIN: The extra works amounted to about £48,000: he (Mr. Martin) apprehended that those were all necessary extras, for the contractor said, "I agree to execute same with all necessary extras for the sum of £274,000."

Mr. REDMOND: That is not the intent.

Mr. MARTIN said, if that were not so, it should be cleared up distinctly by the contractor.

Dr. GRAY said that Mr. Martin should have looked at the first paragraph, where he would have seen that the extra works referred to were all extra works requisite to complete fully the improved and revised plans.

Mr. MARTIN said he should once more express his concurrence in the observations of Alderman Roe, and hope that the work would be carried out within reasonable time, the citizens of Dublin being naturally impatient on the subject, as they were at present liable to a heavy water-rate. He was sure the committee would make all necessary arrangements to compel the contractor to carry out the works within the specified time.

Dr. GRAY: Within two years.

The report was adopted.

ON MAUVE AND MAGENTA.

By A. W. HOFMANN, Esq., Ph.D., L.L.D., F.R.S., President of the Chemical Society.

(A Lecture delivered at the Royal Institution.)

The fact of the beautiful colouring matters known by these fanciful terms being substances derived from coal must, I presume, be familiar to every one of you. But there may be many unacquainted with the means by which this transformation is accomplished. It is to them that I address myself this evening.

Coal to become colour has to pass through a series of stages of transition, each of which claims our attention for a moment. Briefly expressed, the aim of this address may be said to be to show you the way from coal to colour. Now, let me at once tell you this way is rather long; we may have to travel over country rough and intricate, and now and then to pass through territories which—I confess it with an appeal to the ladies—may not be altogether remarkable for their fragrance and sweetness. But on such occasions we shall accelerate our steps, and, on the whole, I venture to hope that we shall arrive at our journey's end without too much inconvenience.

Colour is intimately associated with light; without light, there is no colour. This remark applies in a double sense to the colours derived from coal; for it is to the introduction of gaslight for illuminating our streets and houses that we are indebted for the acquisition of these colours. This statement may appear strange, for nearly half a century has elapsed during which we have been in the possession of gas, whilst the transformation of coal into colouring matters has been achieved only recently under our own eyes. But you will immediately appreciate the truth of my assertions if I tell you that these substances are obtained from a secondary product, generated in the manufacture of gas, a product long used for a variety of purposes, but which, only within the last few years, the researches of chemists have proved to be an inexhaustible mine of wealth and interest.

The starting-point, then, for the production of mauve and magenta is the manufacture of coal-gas; but this is so well known as not to need any detailed description. Let me briefly remind you of the principal features of the distillation of coal by directing your attention to the two large diagrams representing the "retort-house" and the "condensers" of a gas-work. You observe how the coal is heated in stupendous retorts, five or seven of which are generally associated in one furnace. The gas ascends from these retorts in vertical tubes, the bent ends of which dip into a large horizontal pipe, partly filled with water, called the hydraulic main, a considerable amount of the oily and tarry substances generated with the gas being separated by the water. The gas, so far purified, passes on through the condensers—immense vertical iron pipes, constantly cooled by a current of cold water, which surrounds their external surface. In these condensers, an additional quantity of oily matter is separated, which, together with the oily substances deposited by the gas during its passage through the hydraulic main, is collected in appropriately-placed cisterns. The gas, having traversed the condensers, passes through a series of further purifications before it is delivered into the mains of our streets; but these, unconnected as they are with our subject, must no longer occupy our attention.

The distillation of coal being the fundamental operation in the manufacture of mauve and magenta, it is but fair that it should not remain without an experimental illustration. In this tubulated retort of hard glass, I am heating fragments of coal. The beak of the retort is inserted into a three-necked glass globe, the lower neck of which terminates in a tube communicating with a glass vessel for the collection of the "oily products;" while the third neck is provided with a delivery-tube for the discharge of the gas, which finds its way into a glass gasholder. The coal has been heated only for a few minutes, and the gas already begins to be freely evolved; already I may light it at the orifice of the delivery-tube, which, for this purpose, I have removed from the gasholder; already it burns with the characteristic luminous flame of coal-gas. In the meanwhile, you observe, a considerable quantity of the "oily products" has accumulated in the receiver. Their formation continues as long as the gas is evolved. Ultimately, the coal is entirely resolved into gas and oily products, a non-volatile residue—the coke—remaining behind in the retort.

It is in the oily products, the so-called "coal-tar oil," that our interest is centred. To my mind, this coal-tar oil* is one of the most wonderful productions in the whole range of chemistry. That may be rather a one-sided view; but, having, in younger years, spent much time in the investigation of this substance, I have acquired quite an affection for it. Nor can you fail to appreciate the interest which coal-tar presents to the chemist when you look at the diagram in which I have endeavoured to arrange synoptically the various substances which have been eliminated from it.

Products of the Destructive Distillation of Coal.

Name.	Formula.	Boiling Points. Degs.
Hydrogen	$H\ H$	
Marsh gas, or hydride of methyl	$C\ H_3,\ H$	
Hydride of hexyl	$C_6\ H_{13},\ H$	
Hydride of octyl	$C_8\ H_{17},\ H$	
Hydride of decyl	$C_{10}\ H_{21},\ H$	
Olefiant gas, or ethylene	$C_2\ H_4$	
Propylene, or tetrylene	$C_3\ H_6$	
Caproylene, or hexylene	$C_6\ H_{12}$	55
Œnanthylene, or heptylene	$C_7\ H_{14}$	
Paraffin	$C_n\ H_{n+2}$ (?)	
Acetylene	$C_2\ H_2$	
Benzol	$C_6\ H_6$	84
Parabenzol	$C_6\ H_6$	
Toluol	$C_7\ H_8$	114
Xylol	$C_8\ H_{10}$	126
Cumol	$C_9\ H_{12}$	150
Cymol	$C_{10}\ H_{14}$	175
Naphthalin	$C_{10}\ H_8$	212
Paranaphthalin, or anthracen	$C_{14}\ H_{10}$	
Chrysen	$C_{12}\ H_4$ (?)	
Pyren	$C_{20}\ H_4$	
Eupion	(?)	
Water	$\left.\begin{matrix}H\\H\end{matrix}\right\}O$	100
Hydrosulphuric acid	$\left.\begin{matrix}H\\H\end{matrix}\right\}S$	
Hydrosulphocyanic acid	$\left.\begin{matrix}H\\(C\ N)\end{matrix}\right\}S$	
Carbonic Oxide	$C\ O$	
Carbonic anhydride	$C\ O_2$	
Disulphide of carbon	$C\ S_2$	47
Sulphurous anhydride	$S\ O_2$	
Acetic acid	$\left.\begin{matrix}H\\(C_2\ H_3O)\end{matrix}\right\}O$	120
Phenylic, or alcohol, *phenol*	$\left.\begin{matrix}H\\(C_6\ H_5)\end{matrix}\right\}O$	188
Cresylic acid, or alcohol, cresol	$\left.\begin{matrix}H\\(C_7\ H_7)\end{matrix}\right\}O$	203
Phlorylic acid, or alcohol, phlorol	$\left.\begin{matrix}H\\(C_9\ H_9)\end{matrix}\right\}O$	
Rosolic acid		
Brunolic acid	(?)	
Ammonia	$\left.\begin{matrix}H\\H\\H\end{matrix}\right\}N$	
Aniline	$\left.\begin{matrix}C_6\ H_5\\H\\H\end{matrix}\right\}N$	182
Cespitine	$(C_5\ H_{12})'''N$	96
Pyridine	$(C_5\ H_5)'''N$	115
Picoline	$(C_6\ H_7)'''N$	134
Lutidine	$(C_7\ H_9)'''N$	154
Collidine	$(C_8\ H_{11})'''N$	170
Parvoline	$(C_9\ H_{13})'''N$	188
Coridine	$(C_{10}\ H_{15})'''N$	211
Rubidine	$(C_{11}\ H_{17})'''N$	230

* A large specimen of coal-tar oil was here exhibited.

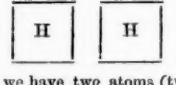
Viridine	$(C_{12}\ H_{19})'''N$	251
Chinoline, or leucoline	$C_9\ H_7\ N$	235
Lepidine	$C_{10}\ H_9\ N$	260
Cryptidine	$C_{11}\ H_{11}N$	
Pyrrol	$C_4\ H_5N$(?)	
Hydrocyanic acid	H C N	

This is rather a formidable list of compounds; their names, too, are not always remarkable for smoothness and melodious character, although, I should not omit to state, they are tame and domestic when compared with some of the terms which chemists of late have been under the painful necessity of inventing and inflicting. You need not be afraid, however, that I shall trouble you with many details about these substances Most of them, though highly interesting for more than one reason, more especially when considered from a purely scientific point of view, are of no importance for our present subject, and need not, therefore, specially be noticed. In fact, the only coal derivatives which, in connexion with mauve and magenta, claim our attention, are benzol, phenol, and aniline; those, certainly, we must, by and bye, examine somewhat more in detail.

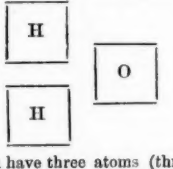
But, before doing so, you legitimately expect that I should endeavour to give you some idea of the nature of the process in which this endless variety of compounds is generated from coal. Were I to tell you simply that coal consists of carbon, hydrogen, nitrogen, oxygen, and sulphur, not to mention the ash which is left after combustion, and that you may, therefore, look upon coal as a sort of magazine of these several elements, capable, under the influence of heat, of associating in an infinity of forms and proportions, you would have learned comparatively little. Let me attempt to convey to you a somewhat more precise idea of the processes involved in the distillation of coal. For this purpose, you must allow me to remind you of some of the general results elaborated by the researches of chemists during the last ten years, which, at the first glance, appear but little connected with mauve and magenta.

The infinite number of substances, mineral, vegetal, or animal, which form our planet, variously as they are composed, may be referred—chemists now pretty generally agree—to a comparatively small number of types of construction. Opinions are divided respecting the actual number of these types, and even the choice of typical bodies is still a subject of discussion among chemists. But, whatever the special views of particular schools may be, the number of types is always small, and among them almost invariably figure hydrogen, water, and ammonia. The comprehension of the meaning attached by chemists to the term "types" may, perhaps, be facilitated to you by a glance at three models, which I have had constructed for this purpose, and which, for the sake of convenience, I may be allowed to designate as type-moulds.*

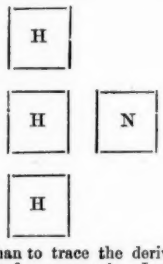
Chemists assume that the smallest particle of hydrogen which exists in the free state, or, to use the chemical phrase, the molecule of hydrogen, consists of two atoms of hydrogen. The first of our type-moulds then, charged as it is with one atom (one volume) of hydrogen, associated with another atom (one volume) of hydrogen, represents the molecule of hydrogen.



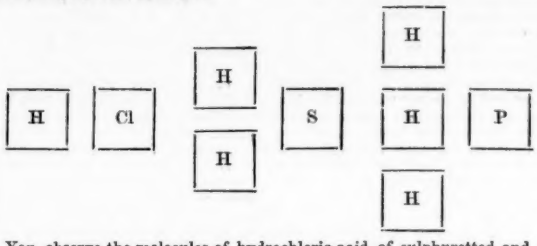
In water, as you know, we have two atoms (two volumes) of hydrogen associated with one atom (one volume) of oxygen.† You are reminded of this fact by our second type-mould, which represents the molecule of water.



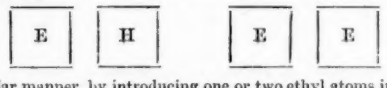
In ammonia, lastly, you have three atoms (three volumes) of hydrogen united with one atom (one volume) of nitrogen, a form of construction which is recorded in our third type-mould representing the molecule of ammonia.



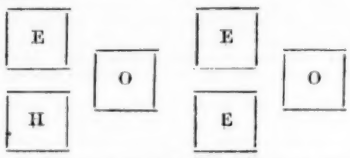
Nothing is easier now than to trace the derivation of other substances from hydrogen, from water, from ammonia. Let me remove from our three type-moulds one atom respectively of hydrogen, oxygen, and nitrogen, and fill the places thus vacated with atoms of chlorine, sulphur, and phosphorus, and I have, without giving you the slightest inconvenience, converted hydrogen into hydrochloric acid, water into sulphuretted, and ammonia into phosphoretted hydrogen.



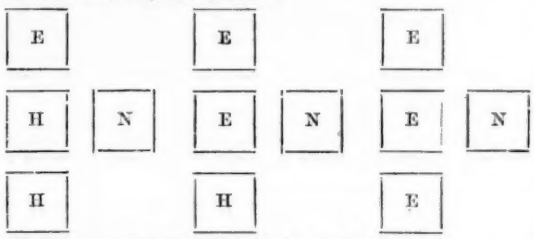
You observe the molecules of hydrochloric acid, of sulphuretted and of phosphoretted hydrogen, respectively contain the same number of atoms which are present in the molecules of hydrogen, of water, and of ammonia. We have thus indicated that hydrochloric acid is constructed upon the hydrogen-type; sulphuretted hydrogen upon the water-type; phosphoretted hydrogen, lastly, upon the type of ammonia. The three bodies just considered were formed by the insertion of elementary atoms; but our type-moulds receive compound atoms with the same facility. Let me take as an illustration, the compound atom, ethyl, consisting of two atoms of carbon, and five of hydrogen ($C_2\ H_5 = E$), which is familiar to the members of the Royal Institution. By inserting one or two ethyl atoms into the hydrogen-mould I generate the molecules of ethylated hydrogen, or ethylated ethyl (free ethyl).



In a similar manner, by introducing one or two ethyl atoms into water, I convert the molecule of water into the molecules of the two ethylated waters, alcohol and ether.

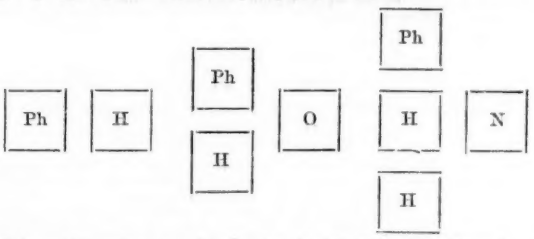


Displace, lastly, one, two, or three hydrogen atoms in ammonia by one, two, or three ethyl atoms, and you give rise to the formation of the molecules of the three ethylated ammonias,



better known as ethylamine, diethylamine, and triethylamine.

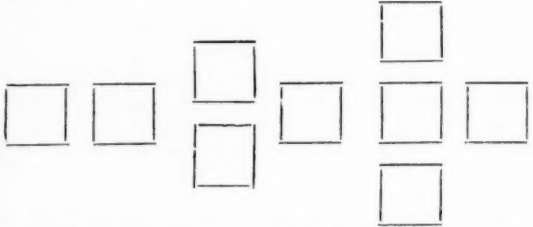
At the risk of exhausting your patience, I repeat some of these changes with another compound atom of a composition differing from that of ethyl. These mauve-coloured cubes may represent a compound atom, containing six atoms of carbon, and five of hydrogen ($C_6\ H_5 = Ph$), to which chemists have given the name of "phenyl." Charge each of our type-moulds with an atom of phenyl, and you accomplish the construction of phenylated hydrogen, phenylated water, and phenylated ammonia,



substances better known as benzol, phenol, and aniline:* and the existence of which in coal-tar oil I have already pointed out to you.

But it is time for us to return to the point from which we started. What has the recognition of our types to do with the distillation of coal? In what manner do they explain the formation of the variety of substances generated in this process? In coal, we have the elements of the three types of matter, and we find that hydrogen, water, and ammonia are in fact produced to a very appreciable extent during its distillation. The quantity of free hydrogen is generally small; moreover, mixed as it is with the carbonetted hydrogens of coal-gas, its presence among the products of distillation of coal is not easily demonstrated by experiment. Water and ammonia, on the other hand, are abundantly generated, and nothing is easier than to exhibit their production. In fact, the coal-tar oil which we have produced in our distillation experiment, is covered, as you observe, with a layer of water, and the application of test-papers to the latter shows that it contains a large amount of ammonia. Now, consider that our types are generated from coal in the presence of large quantities of carbon and hydrogen, two elements which, in proportions varying to an almost

* These type-moulds consisted essentially of wire frames, presenting the outlines of cubes, associated, two, three, or four of them, in the manner indicated in the diagram,



and capable of receiving zinc cubes variously painted and marked, representing elementary and compound atoms.

† Equivalents used: H=1; O=16; S=32; C=12; N=14; Cl=33·5; &c.

* Large specimens of these three substances were exhibited upon the table.

unlimited extent, may aggregate under the influence of heat to compound atoms similar to ethyl and phenyl; remember, moreover, that these atoms are capable of displacing, partly or entirely, the hydrogen of our types, and you will realize without difficulty the number of compounds which may be formed by the distillation of coal; I say which may be formed, for the diagram which I have exhibited to you enumerates only the bodies which have actually been obtained; but, every day brings forth new substances. It is obvious that the nature of the compound atoms generated, must, in a measure, depend upon the composition of the coal distilled. The composition of coal, however, varies between very considerable limits. In the subjoined diagram, I give you a synopsis of the results obtained in the analysis of several specimens of coal.

Analysis of Different Coals.

Locality of Coal.	100 Parts of Dry Coal						
	Contain					Leave	
	Carbon.	Hydrogen.	Nitrogen.	Sulphur.	Oxygen.	Ash.	Coke.
Anthracite, Wales	91·44	3·36	0·21	0·79	2·58	1·52	92·20
" "	90·39	3·28	0·83	0·91	2·97	1·61	92·10
Caking coal, Newcastle	81·41	5·83	2·05	0·75	7·90	2·07	66·70
Cannel coal, Wigan	80·07	5·53	2·12	1·50	8·09	2·70	60·36
Coal, Wolverhampton	78·57	5·29	1·84	0·39	12·88	10·30	57·21
Wallsend, Elgin	76·09	5·22	1·41	1·53	5·05	10·70	58·40
St. Helen's, Lancashire	75·80	5·21	1·92	0·90	11·89	5·17	65·50
Methill brown coal	65·96	7·78	0·96	0·75	9·23	15·32	—
Bohemian brown coal	55·59	4·16	19·06			21·19	—

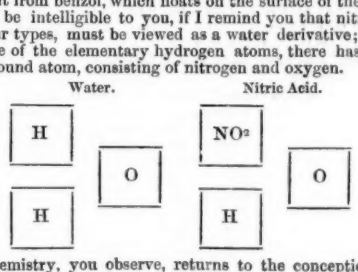
A glance at this diagram shows you that the carbon in the several specimens varies by more than 30 per cent., being 91·4 in Welsh anthracite, and 55·5 in Bohemian brown coal. Similar, though less marked discrepancies are perceptible in the other constituents. If you recollect, in addition, that the nature of the compound atoms generated in the distillation of coal must be influenced, moreover, by the temperature, which again oscillates between limits widely apart, you cannot fail to perceive that the destructive distillation of coal must be an almost inexhaustible source of new compounds.

The separation of the individual substances from the complex mixture called coal-tar oil appears, at the first glance, to present almost insurmountable obstacles. But the principles made use of for this purpose are very simple. The individual compounds contained in coal-tar oil may be separated in a great measure by distillation, their boiling points varying, as may be seen by a glance at the diagram, to a considerable extent. But additional means of purification offer themselves in the different deportment which these substances exhibit under the influence of chemical agents. I could not, perhaps, in this respect, bring under your notice a more instructive illustration than the behaviour with acids and bases of the three coal-tar oil constituents, repeatedly quoted. Benzol, phenol, and aniline, may thus easily be separated. To demontrate this point experimentally, two glass cylinders have been half-filled with benzol, two others with phenol, and two further ones with aniline; a solution of litmus having, moreover, been added, each of the three substances is treated in one cylinder with acid, in the other with alkali. In the case of benzol, you observe the indifferent hydrocarbon, insoluble both in acid and alkali, floating colourless upon the coloured liquid; phenol, being an acid water derivative, is not acted upon by the acid, but readily dissolves in the alkali; aniline, lastly, being a well-defined ammonia derivative, exhibits the converse deportment, resisting the action of the alkali, and forming a homogeneous solution with the acid.

Each of the three coal-tar oil constituents which I have mentioned, and of which you have characteristic specimens upon the lecture-table, has received important applications in the arts and manufactures. Benzol is the most convenient solvent for caoutchouc; as an agent for removing oil and grease it has become an ordinary household article; phenol, when treated with nitric acid, yields us a beautiful yellow dye, called by chemists "carbazotic acid;" but, the practical interest attached to phenol you will more immediately appreciate, if I tell you that this compound presents the greatest analogy with creosote, a substance, I am afraid, but too well known to most of us—a considerable portion of the creosote of commerce being in fact simply phenol; aniline, lastly, is the source of mauve and magenta, and must therefore claim our attention more particularly this evening.

The amount of aniline which exists in coal-tar is very limited; a preparation from this source upon a sufficiently large scale could never be attempted. Fortunately, chemists are in the possession of a series of processes by which aniline may be produced in any quantity. Benzol, the phenylated hydrogen, may readily be converted into aniline, the phenylated ammonia. Let us examine this transformation experimentally.

Benzol is readily attacked by fuming nitric acid; it dissolves in it, producing a liquid of a deep-red colour. On addition of water, this liquid deposits a heavy yellow oil, collecting at the bottom of the cylinder, perfectly different from benzol, which floats on the surface of the water. The reaction will be intelligible to you, if I remind you that nitric acid, when referred to our types, must be viewed as a water derivative; it is water in which, for one of the elementary hydrogen atoms, there has been substituted a compound atom, consisting of nitrogen and oxygen.



Modern chemistry, you observe, returns to the conceptions of former ages, which, in the name of "aqua fortis," appear to have anticipated in a measure our present notions.

When nitric acid acts on benzol, an interchange takes place between the elementary atom of the latter and the compound atom of the former, "nitrobenzol," the heavy yellow liquid, which we have produced, and water being formed:—

Benzol. Nitric Acid. Nitrobenzol. Water.

$$(C_6H_5)H + \left.\begin{matrix}NO_2\\H\end{matrix}\right\} O = (C_6H_5)(NO_2) + \left.\begin{matrix}H\\H\end{matrix}\right\} O$$

The transformation of benzol into nitrobenzol, discovered by Mitscherlich, is only a preparatory operation for the production of aniline. The method converting nitrobenzol into aniline was discovered by Zinin. It consists in submitting nitrobenzol to the action of nascent hydrogen. Under the influence of this agent, the compound atom NO_2, which in nitrobenzol is associated with phenyl, is decomposed; its oxygen is converted into water, the residue of nitrogen and phenyl assimilating the necessary quantity of hydrogen to form phenylated ammonia, or aniline.

Nitrobenzol. Hydrogen.

$$(C_6H_5)NOO + HH + HH + HH =$$

Aniline. Water.

$$\left.\begin{matrix}H\\H\end{matrix}\right\} O + \left.\begin{matrix}H\\H\end{matrix}\right\} O + \left.\begin{matrix}(C_6H_5)\\H\\H\end{matrix}\right\} N$$

The hydrogen necessary for this transformation may be furnished by numerous processes. The most convenient method for our purpose consists in submitting nitrobenzol to the action of metallic iron and acetic acid, a process first proposed by M. Béchamp. I mix the three bodies in a glass retort, and on application of a gentle heat you observe how immediately a most powerful reaction manifests itself. Let us hasten to connect the retort with a condenser; I have removed the gas-burner from the retort; nevertheless, the reaction continues, and a considerable quantity of water, covering an oily layer, has already accumulated in the receiver. The oily liquid is aniline. We recognize it at once by its peculiar deportment with a solution of chloride of lime. On pouring a single drop of our distillate into this beaker, which contains a solution of chloride of lime, a splendid purple cloud is almost instantaneously diffused throughout the liquid. You perceive we are approaching our subject. The beautiful colour which aniline strikes with a solution of chloride of lime has been long known. A solution of bleaching powder has always been used as a test for aniline; indeed, it was by this colour reaction that the presence of our compound in coal-tar oil was first pointed out, a fact recorded in the name kyanol (blue oil), originally given to aniline prepared from coal-tar. Several other oxidizing agents, chromic acid for instance, were likewise known to produce coloured compounds from aniline; but all the colours thus obtained were of a highly ephemeral character. Observe how the purple cloud which I produced by means of chloride of lime has rapidly changed to a dingy reddish precipitate. It was Mr. W. Perkin who had first the happy idea of investigating the circumstances under which this beautiful purple might be prepared in a form permanent and applicable for the purposes of the dyer. He succeeded in isolating this colour by submitting, under appropriately selected circumstances, aniline to the action of bichromate of potassium and sulphuric acid.

Here then you have, step by step, the development of this new and important branch of chemical industry.

Through the kindness of my friend, Mr. Perkin, I am enabled to exhibit to you magnificent specimens of his aniline purple, or mauve, in the dry state and in solution. This brown lump, with the remarkable coppery lustre, is mauve in the solid state; its extraordinary tinctorial powers will be appreciated, if I tell you that this beautiful violet-coloured solution contains not more than 1-10th of a grain of mauve in one gallon of alcohol; you will also understand the considerable commercial value of this substance. Weight for weight, I am told by Mr. Perkin, this colouring matter when pure, is sold at the price of metallic platinum.

Very little is known regarding the chemical nature of mauve; its composition is not yet made out, and, as a matter of course, the process by which it is formed from aniline remains as yet perfectly unexplained.

Magenta is one of the fancy names given to the splendid crimson, which is likewise generated from aniline by the action of oxidizing agents. This substance was first observed in purely scientific researches, and more especially in the action of tetrachloride of carbon upon aniline. To a French chemist, M. Verguin, the merit is due of having for the first time obtained this substance on a larger scale; he produced it by the action of tetrachloride of tin on aniline. Numerous other processes were subsequently suggested, among which treatment of aniline with chloride or nitrate of mercury with arsenic acid, and many other substances, may be mentioned. Magenta, often called fuchsine, roseine, &c., soon became an article of large consumption. A great impetus to this new branch of industry was given in France by Messrs. Renard and Franc, who were the first to manufacture the new article on a commercial scale; in this country, very soon afterwards, Messrs. Simpson, Maule, and Nicholson engaged with great spirit in the manufacture of this splendid dye, the production of which has attained already colossal proportions. To Mr. E. C. Nicholson more especially belongs the credit of having developed this new industry to an unprecedented degree of perfection.

Before proceeding, however, let me show you the formation of magenta by experiment. Among the many processes which I might adopt for this purpose I select the action of corrosive sublimate upon aniline, not because I consider this process superior to the others—it is, in fact, inferior to many—but because it is, perhaps, the best adapted for a lecture experiment. This white powder is chloride of mercury (corrosive sublimate); a small portion of this salt I mix in a test-tube with perfectly colourless aniline. Let us stir the mixture with a glass rod until it is converted into a perfectly homogeneous liquid paste. This paste is still colourless, but, on gently heating it by a gas-burner, it instantaneously assumes a splendid crimson of the greatest intensity, a single drop of the liquid being capable of deeply colouring a large beaker filled with alcohol.

In all the processes which convert aniline into colouring matters, a considerable number of scondary products are generated, which it is rather difficult to separate from the principal product of the reaction. These difficulties have been most perfectly overcome by Mr. Nicholson, who has succeeded in obtaining magenta in a state of absolute purity. Chemists have thus been enabled to analyze this substance, and to lift at all events the corner of the veil which still covers the mysterious formation of the coloured derivatives of aniline.

In the pure state, magenta is a fine crystalline, and remarkably enough, perfectly colourless, or only slightly-tinted body, which is represented by the formula—

$$C_{20}H_{21}N_3O = C_{20}H_{19}N_3,H_2O.$$

Rosaniline (this is the name by which chemists designate the colourless body) is a base, or ammonia derivative, which forms a series of splendid salts. With hydrochloric acid, for instance, it produces a beautifully crystalline salt of the formula—

$$C_{20}H_{19}N_3,HCl.$$

It is in the state of saline combination that rosaniline acts as a crimson

dye. Into this shallow porcelain dish I have thrown a few crystals of rosaniline, which at a distance you scarcely perceive; I now pour upon these crystals a small quantity of acetic acid, when, on gently heating the dish, the crimson colour instantaneously appears. But it is only in solution that even the salts of rosaniline are crimson coloured; on slowly evaporating their solution, the red colour entirely vanishes, and a splendid green crystalline substance remains, presenting in an extraordinary manner the beautiful metal lustre which distinguishes the wings of the rose-beetle. Together with all the products involved in the manufacture of aniline and aniline dyes, my friend, Mr. Nicholson, has placed before you the finest series of rosaniline salts which has ever been produced; and, not content with this display, he was kind enough to send us a specimen of acetate of rosaniline, such as no mortal eye has ever seen before. The specimen may be literally called the "Crown of Magenta."* Crowns are always expensive articles, and often are the cost and trouble of getting them greater than their actual value. This remark applies in a measure to the Crown of Magenta. For the benefit of those who are fond of big figures—and who is not a little afflicted with this weakness?—I may state that the crown was grown in a vessel containing not less than £8000 worth of magenta, the crown itself being worth upwards of £100.

Having now explained the several stages of transition through which coal has to pass before it becomes either mauve or magenta, it may be of some interest to you to know the proportion which the finished dye bears to the coal from which it is derived. A set of specimens, for which I am likewise indebted to Mr. Nicholson, is most instructive in this respect. Observe, it commences with a large mass of coal, weighing not less than 100 lbs.; the bottles which follow contain the coal-tar oil, naphtha, benzol, nitrobenzol, and aniline, obtainable in succession from 100 lbs. of coal; remark how they gradually diminish in size, and how small, I might almost say insignificant, appears the bulk of magenta finally obtained. But compare the bulk of wool which this minute quantity will dye. It approximates to the bulk of coal with which we started. This comparison evinces, perhaps, sufficiently the extraordinary tinctorial power which this class of dye possesses, but a very simple experiment may possibly convey to you this idea even in a more impressive manner. The white paper which covers this large frame has been dusted over with a minute quantity of mauve; a second one is treated in a similar manner with magenta. The quantity of colouring matter is so small that the paper has retained its original white colour; but observe how it changes when I dash a beaker full of spirit against these squares; immediately, the lovely purple of mauve is developed upon one of them, whilst the other one exhibits the dazzling crimson of magenta.

But let us now proceed to illustrate the mode of dyeing. For this purpose I introduce silk and wool, both unspun and woven, in succession, into solutions of mauve, of magenta, and, lastly, of a splendid new purple, lately discovered by Mr. Nicholson. Observe the extraordinary facility with which the coal-tar colours are fixed both on wool and silk. These materials require no previous preparation, being dyed, in fact, simply by dipping, without the aid of any mordant. Silk and wool are animal substances; vegetal materials, such as cotton and linen, unless previously submitted to a special treatment, are scarcely affected by these dyes. This fact admits of being beautifully illustrated by dyeing linen fabrics on which ornaments have been embroidered in silk ribbon. The articles, when coming out of the bath, appear uniformly dyed; but by washing, first in pure water and then in dilute ammonia, the colour rapidly vanishes from the linen ground, leaving the silk embroidery in brilliant colours. This extraordinary predilection of the aniline colours for animal substances is, moreover, strikingly illustrated by the condition of my hands, which by this time have acquired a thoroughly magentic appearance. Fortunately, the coal-tar colours are unable to resist the action of chloride of lime, and I have, therefore, only to immerse my hands for a moment into a solution of bleaching powder.

Already the colour on my hand, you observe, has gone, but with the colour, I am afraid, my time too. Let me endeavour to bring this lecture to a conclusion. I have fulfilled, in a measure, the promise which I gave you at the commencement of this discourse. We have crossed together the extensive field which stretches between coal and colour. I am impressed, deeply impressed, with the clumsiness of my performance as your guide, but I hope that the interest attached to the territory we have explored may, to some extent at all events, have indemnified you for the imperfection of my explanations, and that you leave the Royal Institution this evening with the kind of feeling every one of us has more than once experienced after travelling in similar company over a beautiful country—the guide is forgotten, but the impression of the scenery remains.

Having gone thus far, you may think that it is fully time for me to make my bow. But I venture, even at this late hour, to dwell for a moment on the *moral* of the story which I have told you, though you may feel disposed to consider this story rather a highly-coloured one.

The material which I had to condense, I might almost say to force, into the short space of an hour, has been overwhelming; and, whilst explaining the formation of the various substances which I had to describe—whilst illustrating their properties by experiment—I have scarcely had time to glance at the history of our subject. This history is not without interest. You readily perceive that a branch of industry like the one I have endeavoured to sketch could not possibly have risen, like Minerva from the head of Jupiter—a sudden inspiration happily realized. The time, the toil, the thought of a host of inquirers, were necessary to accomplish so remarkable an achievement. You cannot expect me, at this late hour, to examine minutely into this part of the subject, but I must not take leave of you without alluding to some facts which cannot fail to rivet the lively interest of the members of this institution. Let me tell you, then, that mauve and magenta are essentially Royal Institution colours; the foundation of this new industry was laid in Albemarle Street. Benzol, which I have so repeatedly mentioned—benzol, which may be looked upon as the raw material, capable, under the influence of chemical agents, of assuming such wonderful shapes—benzol is the discovery of our great master—may I not add, of our kind friend?—Mr. Faraday. This volume, "The Philosophical Transactions for 1825," contains the description of his experiments. In 1825—thirty-seven years ago—the laboratory of the Royal Institution witnessed the birth of this remarkable body. Yesterday, under the auspices of Mr. Anderson, I invaded the same laboratory, a diligent search was made, and in my hand I hold the trophies of our expedition, the original specimens of benzol which Mr. Faraday prepared. In thus reminding you of one of the early labours of Mr. Faraday—which, owing to the number and vastness of his subsequent discoveries, appears almost to have escaped from his memory like a tradition of years gone by—I have opened a glorious page in the glorious history of the Royal Institution. Benzol has furnished us mauve and magenta, but it has done much more than this. Ever since chemistry became endowed with this wonderful body, benzol has been the carrier of many of the leading ideas in our science. In the hands of Mitscherlich, Zinin, Gerhardt, and Laurent; in the hands of Charles Mansfield—never to be forgotten by his friends—and many others, benzol has been a powerful lever for the advancement of chemical science. Benzol and its derivatives form one of the most interesting chapters in organic chemistry, the progress of which is intimately allied with the history of this compound.

But what has the history of benzol to do with the moral of mauve and magenta? Well, ladies and gentlemen, ask Mr. Faraday; ask him what, in 1825, was his object in examining benzol. I have, perhaps, no right to answer this question in Mr. Faraday's presence. but I venture to say that we owe his remarkable inquiry to the pure delight he felt in the elaboration of truth. It was in the same spirit that his successors continued the work. Patiently they elicited fact after fact; observation was recorded after observation; it was the labour of love performed for the sake of truth; ultimately, by the united efforts of so many ardent inquirers, exerted year after year in the same direction, the chemical history of benzol and its derivatives had been traced. The scientific foundation having thus been laid, the time of application had arrived, and by one bound, as it were, these substances, hitherto exclusively the property of the philosopher, appear in the market-place of life.

Need I say any more? The moral of mauve and magenta is transparent enough. I read it in your eyes—we understand each other. Whenever, in future, one of your chemical friends, full of enthusiasm, exhibits and explains to you his newly-discovered compound, you will not cool his noble ardour by asking him that most terrible of all questions, "What is its use? Will your compound bleach or dye? Will it shave? May it be used as a substitute for leather?" Let him quietly go on with his work. The dye, the lather, the leather will make their appearance in due time. Let him, I repeat it, perform his task. Let him indulge in the pursuit of truth—of truth pure and simple—of truth, not for the sake of mauve, not for the sake of magenta—let him pursue truth for the sake of truth!

* An immense aggregate of sparkling green octohedral crystals—some of them as much as an inch in diameter—deposited upon a large wire frame, having the shape of an elegant crown, was here exhibited.

THEORETICAL FORMULÆ FOR THE MOVEMENT OF AIR IN CONDUIT-PIPES.

By Gen. A. Morin, Academy of Sciences of Paris.

[From the *Comptes Rendus de l'Académie des Sciences.*]

In the work upon the steam-engine which I had the honour to present to the Academy of Sciences in 1843, I had, among other questions, treated of the movement of steam from its issuing from the boiler until its entry into the cylinder. The application of the principle of living forces, and of the rules admitted to estimate the influence of the various circumstances which the circulation of this fluid presents, to a steam-engine established in the shops of the *Messageries Royale*, had moreover shown me that the results of experiment were as conformable to those of theory as one could hope for in such investigations.

As I have been induced for some time past to occupy myself with questions which are connected with the movement of elastic fluids, and especially with that of air in ventilation apparatus, I thought that, whilst it was indispensable to consult experiment, it was also necessary to ask of science, rules which might guide us in the establishment of the apparatus. I was thus led to seek for the means of establishing the formulæ for the movement of air, applying to it the principle of living forces, or of the transmission of work, according to the rules indicated by Borda, and developed by M. Poncelet in his lectures at the school at Metz.

In this work, of which I propose to give to the Academy an analysis as succinct as possible, I begin by establishing the equation of the transmission of work, taking into consideration all the losses of living force which can be produced in the air-conduits, and of the work consumed by the passive resistances.

This question has also been treated, partially at least, by a distinguished physicist, whose still recent loss science regrets; but, beside the fact that he did not complete the solution, he committed errors in the mechanical part of the question which it is important to rectify.

In the movement of the air through the pipes of the apparatus for warming and ventilation, where recourse has not been had to machines, the motive force is due only to the difference of the pressures, densities, or temperatures, and, after finding the expression for them, we must equate it to all the losses of living forces which may be produced, added to the work consumed by the resistance of the walls.

The losses of living force are or may be very numerous, but we have rules for calculating them. It will be sufficient if I enumerate them. They are produced—

1st. At the entrance of the pipe in consequence of the contraction there, which is scarcely ever avoided. The expression is (as is known) of the form $M\left(\frac{1}{m}-1\right)^2 v^2$; M being the mass of air passing in 1 sec.; v the mean velocity in the pipe; m the co-efficient of contraction at the mouth.*

2nd. At leaving the chimney or pipe, the air possesses a living force which is not utilized, and which is greater in proportion as the orifice is more contracted.

3rd. When the orifice of entry of the air into the pipe has a section notably smaller than that of the pipe, the loss of living force after passing this orifice may be very great. This happens especially when the air has to pass through a grate loaded with fuel.

4th. Every bend also produces a loss of force, and when there are several the loss may be sensible.

5th. The meeting of two currents often produces an analogous effect.

6th. Every enlargement of a pipe has also an influence of the same kind.

7th. As to the resistance of the walls, we know how to express the work which it absorbs; but up to this time the constant co-efficient which enters into this expression has only been determined by the experiments of Girard and of d'Aubuisson, made on pipes of polished sheet iron, and a value has been admitted for this co-efficient $\beta = 0{\cdot}0031$.

The experiments of the late M. Darcy on the movement of water in conduit pipes having shown that the presence of the slightest deposits, such as would diminish the polish of the surface, might triple the value of the analogous co-efficient in water, it is natural to think that the wrinkled surface of pipes of masonry (such as the air flows through in such apparatus), such as are now in question, may have an analogous influence. This is also sufficiently shown by the experiments of M. Peclet.

* This is the proper place to remark that Mr. Peclet, in the formula given in his 3rd edition, p. 114, supposes that this loss is expressed by $M.\frac{1}{m^2}v^2$, which leads to a serious error, and is reproduced in most of his other formulæ.

Taking into consideration all the circumstances of the movement of air, we find for the expression for the volume of air at the temperature of the chimney, which is discharged in one second, by a pipe or by a chimney, under the sole action of the difference of densities, a formula of the form

$$Q = AU = A\sqrt{\frac{2g\left(\frac{D-d}{d}\right)H \text{ or } 2g\,a\frac{(t-T)\,H}{1+a\,T}}{\left(\frac{A}{m'A_1}\right)^2+\left(\frac{1}{m}-1\right)^2+\left(\frac{A}{m'A'}-1\right)^2+\left(\frac{1}{m''}-1\right)^2+\left(1-\frac{A}{O}\right)^2+\frac{2sL\beta}{A}}}$$

Where Q represents the volume of air which escapes in 1 second, in cubic meters;

A	the mean section of the chimney;
U	the mean velocity in that section;
D and T	the density and temperature of the external air;
d and t	" " air in the chimney;
a	0·003665 the co-efficient of dilatation of air;
m	the co-efficient of contraction at the entrance of the chimney;
A_1 and m_1	the area and co-efficient of contraction for the exit from the chimney;
A' and m'	the area and co-efficient of contraction for an orifice of entrance differing from the section of the chimney;
m''	0·65 a co-efficient of contraction for an elbow;
O	the area of a passage greater than that of the chimney;
s and L	the perimeter and length of the pipe whose section is A;
β	the co-efficient of friction of the air against the walls.

Many of the terms in this formula may be repeated a number of times; others may not exist—according to the arrangement of the pipes.

In seeking to appreciate the influence of the various terms which enter into this expression, we recognize at once, as was evident *à priori*, that the volume of air Q, at the temperature of the chimney, which can pass through the pipe, is nearly directly proportional to its transverse section, and, as we may almost always control this section, there results a great facility for obtaining such results as we may desire.

As to the numerator of the fraction which is under the radical, it shows that the velocity in a pipe increases only with its square root, and consequently less rapidly in proportion as it is greater.

This numerator having for its value

$$2g\left(\frac{D-d}{d}\right)H = 2g\,a\frac{(t-T)\,H}{1+a\,T}$$

it is seen at once that it increases; 1st, proportionally to the square root of the height of the chimney (or orifice of discharge) above the entrance-opening, which was known before; 2nd, proportionally to the factor $\frac{t-T}{1+a\,T}$, and that the height H of the chimney being once determined, if we wish to make the velocity of the air nearly constant, this factor must have the same value whatever be the external temperature T.

In the applications to ventilation where the temperatures of the external air are most frequently such that the term $1+a\,T$ differs little from unity,* it will be seen that we always secure the same velocity and, consequently, the discharge of the same volume of air at the temperature of the chimney by maintaining the excess of the temperature of the chimney over that of the external air constant.

Whence results this practical rule, very simple, but only true within certain limits: "To obtain in a given and established system of ventilation by draught the discharge of the same volume of air, whatever may be the variations of the external temperature, it is necessary and it is sufficient to regulate the working of the heating apparatus, so that the excess of the temperature of the air in the chimney over that of the external air may be constant."

This rule is in accordance with a great number of experiments.

As to the denominator, all whose terms are positive, it may in certain arrangements of the pipes acquire a value sufficient to diminish materially the velocity of discharge.

By introducing into it numerical values, and by supposing between the sections of the passages ratios which are frequently met with in practice, I have shown that, in quite common circumstances, the velocity of discharge may be reduced to one-fourth of the value which it would have if these causes of loss were suppressed, and that often it does not exceed one-tenth of this value.

I have just said that the practical rule which I announced was only true within certain limits: in fact, the volume of air discharged by the chimneys to which it applies is not that which it is important to render constant in ventilating apparatus. This volume is that of the warm air which is discharged by the chimney, while the volume of air which assures the ventilation of inhabited buildings is that which is introduced to replace the vitiated air discharged.

Now, it is easy to see that this latter volume, which is at a temperature T lower than that of the chimney (t), is less than the first in the ratio, $\frac{1+a\,T}{1+a\,t}$, whence it results that its expression is

$$Q' = A\sqrt{\frac{1+a\,T}{K}}\ \sqrt{2g\,a\,H}\ \sqrt{\frac{t-T}{(1+a\,t)^2}}$$

and that it is susceptible of a maximum corresponding to the value

$$t = \frac{1+2\,a\,T}{a},$$

which maximum is $Q' = \frac{A}{K}\sqrt{\frac{g\,H}{2}}$,

K representing the radical which forms the denominator of the preceding equation for the value (Q) of the air at the temperature t.

This maximum value for the effect of a chimney has this remarkable about it, that its value is absolute and completely independent of the disposition and arrangement of the apparatus. If the temperature of the external air is 0° Cent., this value is 272°; if T = 10°, t = 282°; and these values are nearly those of the mean temperatures which are established in the chimneys of well-constructed steam-engines.

* It is necessary to notice here a fault of considerable gravity in the formula of M. Peclet. This physicist, in his 3rd edition, vol. ii., p. 37, introduced into the numerator the factor $\frac{t-T}{1+a\,t}$ in place of $\frac{t-T}{1+a\,T}$, which, if applied to chimneys in which the air is strongly heated, might lead to important errors.

Influence of the Section of the Chimney on the Economy of Fuel.—The size of the transverse section of the chimney has not only a favourable influence on the velocity of discharge, but it also has a much more direct and preponderant one on the volume of the air discharged, and this has a notable influence on the economy.

In fact, as the volume of air evacuated from the rooms to be ventilated increases only with the square-root of the factor $\frac{t-T}{(1+a\,t)^2}$, whilst it increases in proportion to the mean transverse section of the chimney, it is easy to see that, whilst an increase of temperature from 20° to 80° augments the volume of air at 10° drawn in only as 1 to 2·19, we should obtain nearly the same increase by doubling the section of the chimney. But this last method would be only an expense to be submitted at once, whilst the increase of the temperature of the air from 10° to 20°, and from 10° to 80°, would increase the expenditure of fuel in the ratio of 10 to 70, whilst the effect of ventilation would increase only as 1 to 2·19.

There is, therefore, a great advantage in employing chimneys of large section and moderate temperatures to obtain the effects of ventilation by draught.

It must, however, be remembered that the stability of the ventilation requires that the velocity in the chimneys of discharge shall not be less than 2 m. or 2·5 m.

Application of the Theoretical Formulæ to different cases, and comparison of their results with those of observation.—After having explained the rules to which theory leads—passing to the application of the general considerations to several peculiar cases—I examine, in the first place, that of a straight chimney under ordinary conditions, and I come directly for this simple case to the following formula:—

$$U = 0{\cdot}9544\sqrt{\frac{D\,H\,(t-T)}{L+16{\cdot}11\,D}},*$$

which expresses the mean velocity in the vertical pipe of a chimney in functions of its dimensions and of the difference of the interior and exterior temperatures.

Now, in seeking to modify, by the discussion of a great number of observations, a formula given by M. Peclet in the 1st edition of his *Traité de la Chaleur*, the inaccuracy of which this physicist had since recognized, a skilful practical man, M. Guerin, engineer for the house L. Duvoir-Leblanc, reached the following rule:—

$$U = \sqrt{\frac{D\,H\,(t-T)}{L+16\,D}};$$

which is, so to speak, identical with that to which the principle of living forces leads.

Comparison of the different Arrangements employed to produce the Draught of the Vitiated Air.—Among the different means of determining the movement of the air in draught chimneys, there are two which have been applied in many large establishments, sanitary and others.

In the one, the furnace which excites the draught is established in the upper part of the building; this has received, with more or less correctness, the name of *draught from above.*

In the other, the furnace is established in the cellar of the building, and all the vitiated air to be extracted is brought there by descending pipes; it may be called, *draught from below.*

Between these extremes there was a third, which it was desirable to study, and which consists in placing the furnace on the same level with the air to be extracted; this, in imitation of the names which we have mentioned, may be called *draught from the level.* This system has been employed in the Polytechnic School, and has just been introduced into the offices of the Northern Railroad.

By applying to these three systems the considerations which we have mentioned, and supposing them of equal proportions in all other respects, we are able to calculate the velocities of the discharge of the air from the different stories of the same building; and, according to the data which we have admitted for the three cases, we have been able to form the following table, which permits the appreciation of the effect of these three systems:—

	Velocity of the discharge of the air.		
	Draught from below.	Draught from level.	Draught from above.
Basement . . .	2·593 mètres.	2·684 mètres.	2·251 mètres.
First story . .	2·508 "	2·450 "	2·144 "
Second story .	2·431 "	2·119 "	1·994 "

This table shows that, of the three systems of draught indicated, according to the hypotheses, and with the same numerical data nearly approximating to the circumstances which may present themselves in practice, that in which the air drawn out is heated on the level of each story, will cause, for the same expenditure of heat, a rather greater velocity for the basement, about the same for the first story, and a little less for the second story, than that in which the draught is produced from below. As to the system in which the furnace is placed above the stories to be ventilated, it will cause, as was to be expected, velocities in all the cases rather less than the other two systems.

The system of *draught from the level* appears, therefore, to be the most advantageous of the three; its superiority and that of the draught from below over that of the draught from above is to be entirely attributed to the fact that, in the first two systems, the heights of the discharge-chimneys permit more advantage to be taken of the specific levity given to the air; but it must not be forgotten that, as the walls of the chimney cool the air which passes through them, the velocity may thus be diminished, and the advantage of this arrangement somewhat reduced.

However this may be, it appears to me to result from this discussion that the system of draught from the level ought to be preferred to the two other systems; its introduction presents no difficulties of construction, and, according to the examination of the proposals for the offices of the Northern Railroad, it appears to be both more economical in cost of construction and of daily expenditure: the great height of the chimneys must also give great stability to the effects.

Introduction of the External Air by the Heating Apparatus.—By examining in a theoretical point of view the conditions of the introduction of air by

* In the formula of Peclet, and consequently probably here, L expresses the length of the flue which opens into the chimney below, the diameter of which is supposed equal to that of the chimney. D is the length of the side of the chimney supposed square, t and T, as before.

hot-water apparatus into the wards of the Hospital Lariboisière, and introducing the data from observation into the formulæ obtained, we obtain the following results:—

The temperature of the air furnished by the stoves being respectively 32°, 26°, 22°, 21° (Cent.),
the values of the velocity of inflow of the air into the wards were found by the formulæ, 1·29 mèt., 1·21 mèt., 1·18 mèt., 1·17 mèt. per second;
by experiment, 1·14 „ 1·04 „ 1·13 „ 1·15 „ „

If we take into consideration the uncertainty which may exist as to the dimensions, and especially the obstacles sometimes inevitable, such as mere spider-webs, which are too often found in the conduit and stove-pipes, it will be without doubt admitted, that the accordance of the formula with experiment is at least sufficiently satisfactory to allow of its being taken, with some latitude, for an approximative rule for the arrangement and proportions to the apparatus in analogous cases.

The formula which is applicable to the cases just mentioned shows this remarkable circumstance, that the temperature of the air which traverses the stoves, which, it may be remarked, is very moderate, has much less influence over the velocity of that air during heating than the air of the ward at its normal temperature. This is the consequence of the slight height given to the stoves.

This result shows the necessity of giving to the stoves as great a height as possible.

As to the introduction of the air in summer, the same formula shows the insufficiency of the orifices offered by the stoves, and I recall in my memoir the easy means of remedying this, which I had already noted on other occasions.

Application to the Apparatus for Ventilation by Draught of the Hospital Lariboisière.—The work which I present to the Academy contains, moreover, a complete application of the principles exposed to the effects of ventilation which are produced in the wings of the Hospital Lariboisière, which are ventilated by draught. It is known that each one of these wings has three stories, each composed of a ward containing thirty-two beds, and a small chamber of two beds. The vitiated air is drawn off from the wards of each story by nineteen discharge-chimneys, which unite under the roof at the base of a general discharge-chimney, in which is the reservoir of hot water intended to stimulate and regulate the draught.

Taking into consideration all the circumstances of the movement of the air in these complex circulations, the mean velocity of discharge in the general chimney may be calculated, and we thus obtain a formula into which, introducing the data of observation of five experiments made, the first two in the winter season, when the temperatures of the external air were —5° and —2° (Cent.), and the last three in summer, at an external temperature of 18·3° (Cent.), then comparing the results of calculation with those of direct experiment, we reach the following results:—

	Temperature of the air.			Velocity in the chimney.	
	External.	Wards.	Chimney.	Formula.	Experiment.
January 11, 1861	—5° Cent.	15° Cent.	19° Cent.	1·465 mèt.	1·39 mèt.
„ 20, „	—2	15	18	1·334 „	1·24 „
August 31, 1861	18·3	21·5	38·1	0·949 „	0·95 „
		22	41·2	1·051 „	0·94 „
		22	40·9	1·041 „	1·07 „

The examination of these results shows that, even for cases as complex as those here considered, the principle of living forces or work leads to formulæ which accord as well with practice as could be expected in such applications.

This comparison also shows the enormous influence exerted by the losses of force and resistance of the walls upon the effects which the difference of temperatures would naturally produce. These two causes conjoined reduce the velocity of discharge in the chimneys to about 0·33 of what it would have been if they could have been avoided; which shows the importance of all the arrangements which diminish these effects, which, however, cannot be entirely got rid of.

Finally, the application of which we have discussed the results shows that, in the denominator of the fraction placed under the radical of the expression for the velocity, the term which depends on the loss of living force enters for 0·864 of its value, and that arising from the resistance of the walls to 0·136 only; which shows the importance of avoiding complicated circulations.

Application of the Discussion of the Experiments made at the Conservatoire des Arts et Métiers.—Besides the application of the theoretic formulæ to the practical apparatus for the circulation of air, others were made for the discussion of the direct experiments which M. Tresca and myself had executed during an investigation into the chimneys of steam-engines.

These experiments, which we propose to resume immediately, were tried under three different conditions:—

1st. Upon a zinc chimney of 0·24 m. diameter and 11 mètres high, entirely open at its two extremities, and under which were successively lighted one, two, three, and four gas-lights.

2nd. Upon the same chimney surmounted by an elongated conical ajutage, of which the upper opening was made to vary by cutting it off, and giving to it successively the diameters 0·10 m., 0·14, 0·18, 0·21.

3rd. Upon a cylindrical chimney of 0·25 m. diameter, surmounting a very conical base placed over a chandelier of 34 burners, and terminated by a conical ajutage, the edges of which were inclined 45° to the axis, and which had successively diameters of 0·210, 0·200, 0·180, 0·158, 0·182, 0·115, and 0·080 mètres.

In all these experiments were observed the external and internal temperature range and the velocity of the air in the pipe, or at its upper termination; the results of these observations were compared with the theoretical formula

$$v_1 = \sqrt{\frac{2\,g\,a\,\mathrm{H}\,(t-\tau)}{1+\left(\frac{1}{m}-1\right)^2+\left(\frac{m_1\,A_1}{A}\right)^2+\frac{28\,L}{D}\beta}}.$$

This comparison shows that, in these three series of experiments, the results of observation follow, as in the preceding cases, the law of the formula. But as this formula does not take into consideration the losses of heat produced by the thin metallic walls of these chimneys, it is necessary in every case to apply to it a co-efficient of reduction, the mean value of which differs very little from 0·8; which shows within what limits the exactness of the theory explains the natural effects.

If the difficulties of the question and the uncertainties of the observations are taken into consideration, and if it be remembered that the greater part of the theories of applied mechanics, and especially that of water-wheels, often do not offer so regular an agreement with observation, it will be, no doubt, admitted that the formula which we have reached may be employed in the study of ventilation with as great a degree of exactness as the requirements of the art demand.

Graphic Representation of the Formulæ and of the Experiments.—When we remark, moreover, that for each peculiar arrangement in which the material data remain the same, and for a determinate mean external temperature, the preceding formula may be put under the form $v^2 = \mathrm{N}\,(t-\tau)$, which is the equation of a parabola; or, more simply, that of a straight line passing through the origin of the co-ordinates, the abscissæ of which are the difference of temperatures $(t-\tau)$, and the ordinates, the squares of the velocities. It may be concluded that, as this straight line may be determined by means of a single well-made observation, we shall thus have, by graphic construction, all the velocities corresponding to the different temperatures, and reciprocally; which conclusion will permit us to solve, without calculation, several interesting questions of application.

Conclusion.—It is seen, by this analysis of the researches which I have the honour to present to the Academy, that the application of the principle of living forces, or of the transmission of work to the movement of the air in chimneys, or apparatus for ventilation by draught, leads to formulæ which, in very different cases, are found in accordance with experiment. These verifications are relative—

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1¼ in.	2 in.	2½ in.	3 in	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lb.

Retail Prices are 5 to 10 per cent. higher.	London.			Glasgow.			Newcastle			Wales.			Yorkshire, Derbyshire, and Staffordshire.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
Pig Iron, No. 1, G.M.B.	3	7	6	2	16	0	2	17	6	3	0	0	3	5	0
1¼ and 2-inch Socket-pipes	7	0	0	6	0	0	6	5	0	6	10	0	6	15	0
2½ and 3-inch ditto	6	10	0	5	10	0	5	15	0	6	0	0	6	5	0
5 and 5-inch ditto	6	0	0	5	0	0	5	5	0	5	10	0	5	15	0
6 inches and upwards ditto	5	15	0	4	15	0	5	0	0	5	0	0	5	10	0
Retorts, 1st fusion, hot blast	5	10	0	4	10	0	4	15	9	5	0	0	5	5	0
Ditto, 2nd ditto, cold ditto	6	10	0	5	5	0	5	10	0	6	0	0	6	5	0
Tank-plates, ¾ thick and above	6	0	0	5	0	0	5	5	0	5	10	0	5	10	0

WROUGHT-IRON TUBING,

Subject to 40 per cent. Discount.

	2 in.		1½ in.		1¼ in.		1 in.		¾ in.		½ in.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Patent Welded Tubes, from 2 to 12 feet—per foot	1	8	1	0	0	10	0	7	0	5	0	4½
Ditto ditto, from 6 inches to 18 inches—each	3	0	2	0	1	9	1	3	1	0	0	9
Connecting-pieces, or Long Screws	3	6	2	3	2	0	1	6	1	2	0	11
Bends, Springs, and Elbows (wrought iron)	3	9	2	3	1	9	1	0	0	10	0	8
Tees, wrought or cast	4	0	2	6	2	0	1	6	1	1	0	10
Crosses, ditto	4	6	3	0	2	6	2	0	1	6	1	2
Iron Cocks	17	6	9	6	7	6	4	6	3	3	2	6
Ditto, with brass plug	28	0	16	0	13	0	7	0	5	6	4	6
Diminishing Sockets, Caps, Plugs, and Nipples	1	3	0	9	0	8	0	6	0	5	0	4
Plain Sockets	1	0	0	8	0	7	0	5	0	4	0	3
Syphons, 2-quart	15	0	14	0	13	6	13	0	12	0	—	

COALS.—*Per Ton.*

Newcastle.—Unscreened.	
Whitwell Primrose	6s. 9d.
Medomsley, Eighton Moor, and Burnhope	7 0
Pelaw	7 3
New Pelton, Pearith, South Pelaw, Washington Hutton, and South Pearith	7 6
Pelton	7 9
Ramsay's Newcastle Cannel	16 0

Scotch Cannel.	
Boghead (at Leith)	45s. 0d.
Kirkness, best	23 0
Capeldrae, 1st quality	20 0
Ditto, 2nd ditto	12 6
Lesmahago (at Glasgow)	23 6
Ditto (at Leith)	27 6
Arniston	27 6
Wemyss	20 0
Knightswood	18 0
Pirnie	14 0

FREIGHTS.

Coastwise—Newcastle.—Per Ton.	
Chatham and Rochester	6s. 3d.
Cork	10 0
Dover and Folkestone	7 0
Dublin	10 3
Exeter Quay	9 6
Ipswich	5 9
London (Pool)	6 6
Lowestoft and Yarmouth	4 9
Lynn	—
Portsmouth and Southampton	7 9
Plymouth	8 3
Shoreham	7 9
Whitstable	7 0
Weymouth	8 6

Foreign.—Per Keel.	
Barcelona	£26 0s.
Bordeaux	—
Boulogne and Calais	£16. to 16 10
Cadiz	15
Cronstadt	12 10
Copenhagen	9 5
Genoa	23 5
Hamburg	9 0
Havre de Grace	10 10
Leghorn	23 0
Lisbon	17 10
Rotterdam	8 10
Stettin	11 5
Trieste and Venice	£22. to 24 0

SUNDRIES.

Best Newcastle Fire-bricks—per 1000	£2. 10s. to £2 15s. 0d.
Cliff's Fire-bricks (at Wortley)—per 1000	2 15 6
Ingham's ditto (at Wortley)—per 1000	2 15 0
Fire-clay Retorts—per foot run	5s. 6d. to 0 7 0
Tough Cake Copper—per ton	98 0 0
English Pig Lead—per ton	20 10 0
Welsh Bar Iron (in London)—per ton	6 10 0
Foreign Spelter—per ton	18 15 0
English Block Tin—per ton	115 0 0
Banca—per ton	116 0 0
Tarred Rope Yarn—per cwt.	1 6 0

First, to the practical formula which observation had led M. Guerin to adopt for ordinary ventilation-chimneys.

Second, to the introduction of hot air by the stoves of the wings of the Hospital Lariboisière, heated by the circulation of water.

Third, to the ventilation in general of these wings, both in winter and summer.

Fourth, to three sets of direct experiments made on metallic chimneys.

From this general accordance of the formulæ with the results of experiment, it appears, therefore, allowable to infer, that we may, without fear of notable error, calculate beforehand the effect of different systems of ventilation by draught, and deduce laws which will be useful in building.

PROPOSED NEW GAS COMPANY IN JERSEY.—A large and influential meeting was held in St. Helier's, on Thursday last, to receive a report from Mr. R. P. Spice, on the subject of the supply of gas in that town, in which he proposed to form a Consumers Gas Company, with a capital of £40,000, for the supply of gas at 5s. per 1000 feet—the price charged by the existing company being 6s. 8d. Resolutions were passed approving of the project, and pledging the meeting to give all the support in its power to the undertaking.

DR. J. NORTHCOTE VINEN'S REPORT ON THE GAS SUPPLIED BY THE SURREY CONSUMERS COMPANY:—

1862. Week ending.	Number of Observations.	Maximum Light. Candles.	Minimum Light. Candles.	Average Light. Candles.
Sept. 20	4	12·69	12·20	12·43
„ 27	4	14·05	13·31	13·79
Oct. 4	4	13·86	12·56	13·22

The average volume of hydrocarbons was 4·16 per cent.; of carbonic acid, 1·0 per cent. No sulphuretted hydrogen or ammonia could be detected. The maximum pressure was 24-10ths: the minimum, 7-10ths.

ANILINE RED, OR ROSEINE.—The Tribunal of First Instance of the Department of the Seine delivered judgment on Aug. 9 in favour of Messrs. Renard, Brothers, and Franc, of Lyons, in an action brought by them against several persons, for the infringement of their patent for the production of aniline red, or roseine, the effect of which judgment, should it be maintained by the superior courts, will be to give to this house a monopoly of the manufacture of this colouring matter, and of its application, for the remaining term of their patent. The *Presse Scientifique*, in announcing this decision, says the matter is of such importance to the dyeing trade of France, that the State must intervene to purchase the patent, and throw it open to the public.

Advertisements.

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STANDARD GASHOLDERS, AND TESTING APPARATUS.

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The daily use of these standards at the Exchequer for eighteen months has fully justified the opinion expressed of them by the Astronomer-Royal, in his reports to the Lords Commissioners of Her Majesty's Treasury, as capable of "being applied to Gas Measures of every class, and Gas-Meters of every class, as accurate as it is possible for human skill to make them."

That opinion has been endorsed by the jury in Class X. of the International Exhibition (several of them being eminent in science and engineering), having awarded the fac-simile of the National Standard and the other Gas Apparatus. Messrs. GEORGE GLOVER and Co. exhibit there the only medal for instruments relating to gas measurement which has been awarded in the Class. The award is for "*ingenuity, completeness, and efficiency of apparatus for measuring gas, and for excellence of material and workmanship.*"

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July 11, 1862.

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Rye, Nov. 12, 1860.

Dear Sirs,—I consider it incumbent on me to acquaint you that the alterations recently made on the Rye Gas-Works—viz., the addition of a NEWLY-IMPROVED WASHER, and other work for the Purification of Gas, executed by the experienced workmen under your able supervision—are perfectly satisfactory to the Company, and the Gas is now as pure as it can be made.

I am, dear Sirs, your obedient servant,
CHARLES THOMAS, Superintendent,
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Mr. ANDERSON continues to Erect, or to supply the Drawings for his PATENT RETORT-SETTINGS. On this principle, three Ovens of Retorts are heated by one Coke and one Tar fire; and, for small Works, the principle is adapted to single Ovens in both cases, with a total absence of smoke, while the duration of the Retorts is from two to three years, and with great economy of fuel.

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This is the most simple machine of the kind in use, being merely a double-action Pump, which any one can comprehend, and works for years without any repair.

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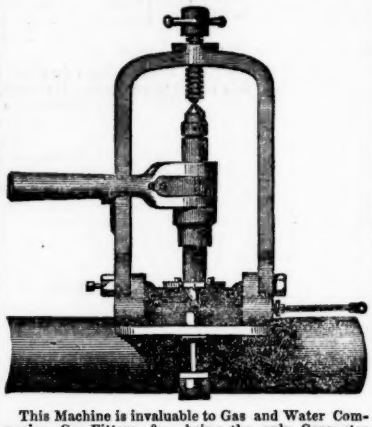

This Machine is invaluable to Gas and Water Companies, Gas-Fitters, &c., being the only Connector whereby accidents can be prevented. It is simple in construction, economical in saving the escape of Gas, and can be worked by a labourer.

No. 1 size, to suit ¾ and 1 in. Services, £6. 6s. each.
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This Governor combines great delicacy with remarkable certainty of action. A pressure of one-tenth of an inch of water, operating on a diaphragm of 3 inches diameter, is sufficient to work the Regulating-Valve of an Engine of any power.

TESTIMONIALS.

Borough Engineer's Office, Town Hall
Halifax, March 29, 1862.

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The Governor has been perfectly self-acting, and has never given us one moment's thought, trouble, or expense. The engine-man has only to weight the tappets to the required vacuum, and the pressure-register paper never shows a greater variation than three-tenths in the twenty-four hours.

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I am, dear Sir, yours faithfully,
G. W. STEVENSON.

Denny Lane, Esq., Cork Gas-Works,
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Gas-Works, Cork, April 4, 1862.

Dear Sir,—Having for some time past had in use three of your newly-invented Regulators for governing the speed of Steam-Engines in connexion with Gas-Exhausters, I am glad that I am able to speak of this valuable machine in terms of the highest praise. I have had them applied, as you know, to high-pressure and condensing engines, with Beale's and also Anderson's Exhausters. In every case, this small and valuable instrument is thoroughly effective in regulating the speed of the Exhauster. No amount of care with the hand can equal its accuracy of action for the intended purpose.

Denny Lane, Esq. A. H. STILL, C.E.

An Illustrated Circular, explaining the operation of the Governor, can be obtained by application to D. LANE, 72, South Mall, CORK; and the Governor can be seen in London at the Offices of GEO. ANDERSON, Esq., C.E., 16, Adam Street, ADELPHI.

JAMES OAKES and CO.,
ALFRETON IRON WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 20, WHARF ROAD, CITY ROAD, LONDON,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.

N.B.—Orders for Cast-iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.

CHARLES HORSLEY, Agent.

HENRY BALFOUR AND CO.,
ENGINEERS & IRONFOUNDERS,
DURIE FOUNDRY,
LEVEN, FIFE;
& 16, ADAM STREET, ADELPHI, LONDON, W.C.

Gas Engineers and Contractors for Gas and Water-Works; manufacturers of Steam Engines and Exhausters, Steam Boilers, Gasholders, Cast-Iron Tanks, Purifiers, Condensers, Iron Retorts, Gas and Water Pipes.

Plans, Specifications, and Estimate furnished for new, or for extensions and alterations on existing, Works.

ALFRED PENNY, Gas and CONSULTING ENGINEER,
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Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, T-pieces, &c. &c.

Plans, Specifications, and Estimates prepared.

INTERNATIONAL EXHIBITION,
1862. CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
good quality of Fire-Bricks.

WILLIAM STEPHENSON & SONS,
THROCKLEY,
NEWCASTLE-ON-TYNE,
MANUFACTURERS OF EVERY DESCRIPTION OF
FIRE-BRICKS, CLAY RETORTS
&c. &c.
RETORT MOUTHPIECES, BOLTS, NUTS, &c.

GEORGE BOWER,
GAS ENGINEER, MANUFACTURER,
AND CONTRACTOR,
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References to between 100 and 200 Gas-Works Designed and Erected by the Advertiser.

LESLIE'S PATENTS: Gas and Coke from common Coal, greatly increased in value.—60, Conduit Street, LONDON, W.

LESLIE'S PATENTS: Up to Forty Candle Gas.—60, Conduit Street, LONDON, W.

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LESLIE'S PATENTS: The National Waste Heaps at Collieries UTILIZED for Gas purposes.—60, Conduit Street, LONDON, W.

STOURBRIDGE FIRE-CLAY WORKS.
E. BAKER and CO.
(Contractors to Government).
24 WHARF, HARROW ROAD, PADDINGTON, W.

Every article manufactured at their own Works and Mines, Brierley Hill.

FIRE-BRICKS, Lumps, Squares, Tiles, and Gas Retorts of all dimensions.
CRUCIBLE and CEMENT CLAYS.
GARDEN EDGINGS, of various patterns.
BUFF and ORNAMENTAL TILES.
CLINKERS and STABLE PAVINGS, noted for hardness and durability, being perfectly non-absorbent.

Shipments on the shortest notice.

BEVERLEY'S Patent Equitable GAS-METER,
From which the Water cannot be abstracted.

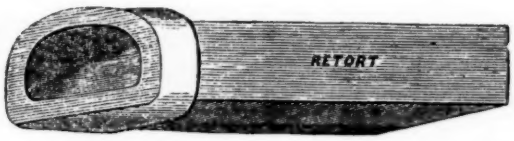
JOHN BEVERLEY & SON,
GAS-METER MANUFACTURERS, &c.,
LEEDS, YORKSHIRE,

Are prepared to supply the above Meters, either stamped or otherwise, and to adapt their patented principle to any old Meters that may be sent to them to be repaired, tested, and stamped.

Manufactory, No. 9, Mark Lane, LEEDS.

KING BROTHERS,

STOURBRIDGE FIRE-BRICK AND RETORT WORKS.



KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them FREE FROM CRACKS AND CORRECT IN FORM. By great care in Manufacturing, combined with the advantages in burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonize.

Retort Ovens, Fire-Bricks, Guards, Saddles, Rabbitted Burs, Flues, and Quarries, are all Manufactured of the same quality of Clay.

Every Retort and Brick is branded "King Brothers, Stourbridge."

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WROUGHT-IRON TUBES, FOR GAS, WATER, & STEAM; CAST-IRON RETORTS & PIPES;

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Contractors for Gas-Works of any Magnitude. *Plans, Specifications, and Estimates furnished.*

SOLE AGENT FOR THE SOUTH, SOUTH-EAST, AND SOUTH-WEST OF ENGLAND:—

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TRUSS'S PATENT ELASTIC PIPE-JOINT,

FOR GAS AND WATER-MAINS, AND STEAM PIPING,

Is the only PERFECT joint that has ever been constructed, and supplies the long-felt desideratum, by allowing for the expansion and contraction of metals, and for oscillation and deflection, without impairing the joint. Gas Companies will effect an incalculable saving in adopting it, as compared with the present imperfect mode of jointing.

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ALBION TUBE-WORKS, BIRMINGHAM,

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PLAIN, GALVANIZED, & ENAMELLED, for Gas, Steam, and Water, from $\frac{1}{8}$ in. to 6 in. bore.

STOCKS TAPS, and DIES, GUN METAL GLAND-COCKS, WATER-GAUGES, &c.;

PATENT LAP-WELDED IRON TUBES,

For Locomotive and Marine Boilers, &c.

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FIRE-CLAY GAS RETORTS.

ESTABLISHED IN 1795.

JOSEPH CLIFF and SON,

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Are Awarded the PRIZE MEDAL for Excellence of Material and Manufacture of Clay Retorts, July 11, 1862.

Class X., No. 2259.

THESE RETORTS are unrivalled in excellence, being the BEST FINISHED INTERNALLY, and THE MOST CORRECT IN FORM, of any in the Kingdom. From the peculiar composition used in working up the face of the material, they are rendered unusually smooth, close, and FREE FROM SURFACE CRACKS, thus, in a great measure, preventing leakage and the adhesion of carbon to their interior surface.

To meet the yearly increasing demand of UPWARDS OF THIRTY SEASONS and to carry out the late improvements in the manufacture, the Premises have been re-erected and much enlarged, and Engineers may rely WITH CONFIDENCE on their orders being completed with a greater regard to despatch than by any other House.

THE WORKS ARE WELL SITUATED

For EXPORT from the Ports of LONDON, LIVERPOOL, HULL, MIDDLESBRO', HARTLEPOOL, and STOCKTON.

FIRE-BRICKS, LUMPS, GUARDS, TILES, AND CLAY OF THE SAME QUALITY.

M. R. NEWTON, London Agent, No. 4, Wharf, King's Cross Goods Station.

WILLIAM INGHAM AND SONS,

WORTLEY FIRE-BRICK AND RETORT WORKS,

Near

Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY,

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

Estimates for Setting, or Bricklayers sent when required.

GAS OVENS IN SEGMENTS OF EQUAL QUALITY.

A large stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all sizes kept in London at CHRISTIE & CO.—Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.

N.B.—*Export orders continue to have prompt attention.*

WILLIAM RICHARDS,

SOLE INVENTOR AND FIRST MANUFACTURER

OF THE

DRY GAS-METER,

Which obtained Prizes at the Exhibitions of London, 1851; New York, 1853; Paris, 1855; and three Prizes at the present Exhibition of 1862.

CRAWFORD PASSAGE, COPPICE ROW, CLERKENWELL, LONDON.

W. RICHARDS invites the attention of Gas Companies and Engineers to the Dry Meter manufactured by him, as possessing advantages over others, by his method of disposing of the flexible material, so that collapsing or bagging of the same is avoided. This defect, so conspicuous in some of the meters of other makers shown at the Exhibition, causes the measurement of the instrument to vary under different circumstances, and the durability of the same is materially impaired.

In the meters manufactured by W. Richards, all the metals of the working parts are incorrodible; the flexible material, the best that can be employed; and, in general construction, they are not to be surpassed.

To those who prefer the Wet Meter, W. Richards submits his patented improvements in the same, which consist in contracting the measuring-wheel at, and near, the water-line—thus allowing of a longer range for the float, and avoiding the sudden extinctions now so common; also, a simple remedy is applied to prevent fraudulent consumption, which the operation of the Sales of Gas Act has so much facilitated.

TELL-TALE EXHAUST AND PRESSURE-INDICATORS;

GOVERNORS, STATION-METERS, &c.

WILLIAM SUGG,

MANUFACTURER OF

PATENT DRY AND WATER GAS-METERS, TEST GASHOLDERS, AND APPARATUS,

"EVANS'S" PHOTOMETERS,

Experimental Meters, Minute Clocks, &c., Station-Meters and Governors,

STREET-LAMP GOVERNORS AND LAVA BURNERS,

19 and 20, MARSHAM STREET, WESTMINSTER.

INTERNATIONAL EXHIBITION, 1862.

TWO PRIZE MEDALS.

Class 13, No. 2973.

PHOTOMETERS, &c.,

Jury Award: PRIZE MEDAL,

For "Photometric Apparatus—for a well-constructed Apparatus to determine the Illuminating Power of Coal-Gas."

(PHILOSOPHICAL INSTRUMENTS, *North Gallery.*)

Class 31, Section B, No. 6350.

METERS, GOVERNORS, &c.,

Jury Award: PRIZE MEDAL,

For "General Excellence of Workmanship, and for his Improvements in Gas-Burners and Photometrical Apparatus."

(*Opposite* AMERICAN DEPARTMENT.)

LIVESEY FIRE-CLAY WORKS,

NEAR BLACKBURN, LANCASHIRE.

ORLANDO BROTHERS,

MANUFACTURER OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

INTERNATIONAL EXHIBITION, 1862.

Class X. No. 2265.

THE JURORS HAVE AWARDED TO

JOSEPH COWEN & CO.,

BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,

THE PRIZE MEDAL FOR "GAS RETORTS, FIRE-BRICKS, &c., FOR

EXCELLENCE OF QUALITY."

JOSEPH COWEN & CO. were the only parties to whom a Prize Medal was awarded in the Great Exhibition of 1851 for

"GAS RETORTS AND OTHER OBJECTS IN FIRE-CLAY."

SERVIER'S

PATENT

SELF-ACTING GAS GOVERNOR.

This Instrument, which is designed to replace the ordinary Governor,

Operates solely by the Action of the Gas, without any Alteration of Weights, or the Assistance of any intermediate Agency or Apparatus whatever;

And it will maintain a Constantly Uniform Pressure in Gas-Distributing Mains, at any given point of their circuit.

All Applications for Licences to Manufacture or to Use the Apparatus to be made to

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WILLIAM & BENJAMIN COWAN,

PATENT WET & DRY GAS-METER MANUFACTURERS,

Buccleuch Street Works, Edinburgh, & 13, Strutt Street, Manchester.

Established 1827.

SOLE MANUFACTURERS OF

ESSON'S PATENT COMPENSATING GAS-METERS;

KAY'S PATENT HYDRAULIC VALVE GAS-METERS;

Also, DRY METERS OF THE MOST APPROVED DESCRIPTION;

All of the above being Stamped under the Provisions of the SALE OF GAS ACT.

W. and B. C. likewise supply ESSON'S PATENT COMPENSATING FOUNTAINS, and KAY'S PATENT HYDRAULIC VALVES, now so extensively used for bringing ordinary Meters within the requirements of the Act of Parliament. Gas Companies can, therefore, either attach the FOUNTAINS or VALVES to their old Meters themselves, or forward them to W. and B. C. for Alteration and Stamping.

COVERNORS, STATION-METERS, PRESSURE-REGISTERS & CAUCES,

MINUTE-CLOCKS, PHOTOMETERS, EXPERIMENTAL METERS,

AND ALL OTHER DESCRIPTIONS OF GAS APPARATUS.

INTERNATIONAL EXHIBITION,

Class 31 (Sub-Class B), No. 6288.

International Exhibition, 1862.

MESSRS.

CROLL, RAIT, AND CO.,

Manufacturers of Croll's Patent Improved

DRY GAS-METER,

Exhibited in Class XXXI. (B),

Have obtained the Medal for

"GOOD CONSTRUCTION AND SOUND WORKMANSHIP."

FACTORY:

CANAL BRIDGE, KINGSLAND ROAD, LONDON, N.E.

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MANUFACTURER OF

CONSUMERS' COMPENSATING & NON-COMPENSATING WET GAS-METERS,

Of the best material and workmanship, carefully adjusted to meet the requirements of the SALES OF GAS ACT.

STATION-METERS & GOVERNORS,

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STANDARD TEST GASHOLDERS;

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EXPERIMENTAL TESTING APPARATUS,

Employed by the best experimenters in this country and on the continent, and by the Gas Testers in the London districts.

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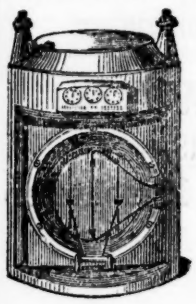
"Analysis of Gas for Practical Men," by A. WRIGHT, M. Inst. C.E., post-free for 13 Stamps. PRICE-LISTS ON APPLICATION.

JAMES MEACOCK,

PATENT DRY AND WET GAS-METER MANUFACTURER,



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ESTABLISHED 1836.

J. M. invites attention to his Improvements in EXPERIMENTAL WET GAS-METERS, by which he renders impossible any Leakage from the Stuffing-Box.

These METERS are GUARANTEED to meet all the Requirements of the SALE OF GAS ACT

GOVERNORS, STATION-METERS, PHOTOMETERS,

EXPERIMENTAL TESTING GASHOLDERS, HIGH-PRESSURE GAUGES,

AND ALL APPARATUS IN USE AT THE GAS MANUFACTORY.

D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,

invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

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GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas Apparatus.

CAST & WROUGHT-IRON PIPE BLACK & GALVANIZED. COPPER. TIN, BRASS, & COMPOSITION TUBING.

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for clearing out Mains, Services, and Interior Fittings—60s. net.

Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns.

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Large Pattern Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.

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